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Contents

Sweet Potato Growing in Central Queensland.

O. L. HASSELL, Senior Adviser in Agriculture.

ALTHOUGH there are thousands of acres of soil in east-central Queensland eminently suitable for the growing of sweet potatoes, this crop has not received the attention it merits. Several growers who have appreciated the value of sweet potatoes for pig feed have planted areas as large as 200 acres, but for the most part plantings are small. When English potatoes are available there is not a large market demand for sweet potatoes, but there is a number of varieties at present being grown in this area which are first class table varieties.

With the likelihood that the prevailing high price for pigs will continue for some time to come, the possibilities for the expansion of sweet potato growing for feeding pigs in central Queensland are considerable. In the Rossmoya district near Rockhampton one grower has 200 acres under sweet potatoes. The practice he has found most profitable is to grow the potatoes on the same land for three years, thus allowing for two ratoon crops. With the supplementary feeding of other foods such as grain sorghum and meatmeal, this farmer has turned off an average of 500 baconers for some years past. Another grower in the same locality usually has 100 acres under sweet potatoes and turns off approximately 300 baconers per year.

Soils.

All heavy clay soils should be avoided for this crop. In central Queensland the most suitable soils have proved to be the red clay loams and red loams of the Rossmoya, Milman and Mt. Larcom districts. The sandy alluvial loams of the coastal and inland areas and the brown loams of the softwood scrubs of the Callide and Dawson Valleys also favour the successful production of sweet potatoes. Sweet potatoes do well following the ploughing-under of a leguminous green manure crop.

Propagation.

The sweet potato is propagated from cuttings. Tubers for the purpose of obtaining cuttings should be planted as soon as all danger of frost is over. Careful selection of tubers is worthwhile. The selection should be confined to plants producing satisfactory yields of

smooth, well shaped, marketable roots of a type characteristic of the variety to be propagated. Before planting, all tubers should be inspected to see if there is any sign of the sweet potato weevil.* If any infestation is present the tubers should be discarded and material from a known clean area obtained.

Selected tubers should be planted in a nursery plot of well drained fertile soil, where irrigation can be applied if required. If the tubers are well shot when planted, a good supply of runners can usually be obtained in six weeks. With some rambling varieties many hundreds of cuttings can be obtained from one tuber in a season.

Varieties.

The sweet potato requires a growing season of three-and-a-half to five months, and in accordance with their maturing habits types can be classed as early, mid- or late-season. Varieties that have been grown for many years in the central district and which can be recommended for planting for both pig feed and culinary purposes are White Maltese and Porto Rico. Both are mid-season types and heavy yielders. These varieties, together with a number of others which have been tried in recent years, are described below.

Porto Rico (Plates 1 and 2).

Several strains of Porto Rico have been grown, including a local strain, Porto Rico (Unit 7) and Porto Rico (Bunch). The first two are similar. The leaf is of variable shape and size but for the most part is large with distinct shoulders. The veins are green in Porto Rico (Unit 7) and purple in Porto Rico (local) with a purple spot at the base of the leaf in both strains. The stem is purple and an abundance of vine and leaf is produced, especially with Porto Rico (local). The tubers are medium to large in size, well shaped, with bronzy pink skin; the flesh is yellow, with dry texture and good flavour. Both strains are mid-season and are strongly recommended for culinary purposes and for grazing by pigs. In central Queensland at present Porto Rico (local) is widely used for pig grazing.

In Porto Rico (Bunch) the leaf is very large and has distinct shoulders, green veins and a purple spot at the base. The stem is purple, the growth is characteristically bunched and there are no runners. The tubers are elongated and have a light pink skin; the flesh is yellow, with only fair texture and flavour; maturity is late. This variety has not shown great promise for farm conditions because its yield is below average but it would no doubt be useful in home gardens where a bunched growth and an absence of runners are desirable.

White Maltese (Plate 3).

In the White Maltese variety the leaves are small and heart-shaped, with the main vein purple and lateral veins green; a purple spot occurs at the base of the leaf. The stems are green and thin but the variety rambles extensively. Tubers have a rough white skin and may grow to a great size under good conditions; the flesh is white, with soft texture and a sweet flavour; it is a mid-season type. This variety is a heavy yielder and has been popular in the central district for many years, especially as a grazing crop for pigs.

* *Cylas formicarius* Fabr.

Abundance (Plate 4).

Abundance is a good variety for both culinary and grazing purposes and is recommended, especially for sandy coastal lands. The leaf is characteristic, being small, pointed and slightly shouldered, with green veins. The stems are green, thick and hairy and the variety exhibits a strong rambling habit of growth. The tubers are usually long and tapering, with a slightly wrinkled red skin; the flesh is white with grey flecks, stringless and floury in texture, and with a very good mild sweet potato flavour. The variety is a mid-season type which yields heavily on light soils.

Brooks' Gem (Plate 5).

The leaf of Brooks' Gem is of medium size and fan-shaped, with a distinct frill and purple veins which make the variety readily distinguishable. The stem is green, smooth and of a medium thickness, while growth is bunched and of a non-rambling habit. The tubers are long and tapering, with a rough white skin; the flesh is white, with a floury texture and very sweet flavour. This is an excellent table variety and most suitable for digging, as the crop is carried under the vine in the row in which it is planted.

Louisiana No. 9 (Plate 6).

Louisiana No. 9 is a new variety in Queensland. The leaf is medium to large in size, tending to a round shape, with green veins and a purple spot at the base. The stem is of medium thickness, green with purple tinges: growth habit tends to be bunchy and runners are not produced freely. The tubers are medium sized, with a smooth, light pink skin; the flesh is yellow with a dry texture and an attractive flavour which makes it very suitable as a table variety. The variety is late-maturing and only a medium yielder, but its good cooking qualities make it popular.

Nancy Gold (Plate 7).

Nancy Gold is also a comparatively new variety. It has small heart-shaped leaves with slight shoulders and the veins are green and well defined. The stem is green, thick and slightly hairy, and growth is of a semi-rambling habit. The tubers are round and evenly shaped, with a very light pink skin showing veins; they are borne close to the surface of the ground. The flesh is deep yellow but the texture is too soft and watery to be popular. The variety is an early type of medium yielding ability.

Alton Downs Red (Plate 8).

Alton Downs Red is a good general purpose sweet potato which is early maturing and a heavy yielder. The leaf is medium sized and elongated, with shoulders; the veins are purple. The stem is of medium thickness, green with purple shades merging into deep purple at the axis of the leaf; the growth is of a moderately rambling habit. The tuber is elongated, with a smooth, light red skin; the flesh is yellow, with a dry stringless texture and of excellent flavour.

Nancy Hall (Plate 9).

Nancy Hall is a new variety which up to the present has not been particularly successful in the central district, but it appears to be worthy of further trial. It is a mid-season variety of medium yielding

capacity. The leaves are of medium size and heart-shaped, with green veins. The stem is green and of medium thickness and the vines ramble extensively. The tuber is large, with a smooth, very light pink skin; the flesh is light yellow, of dry texture and of fair flavour.

Porto Morada (Plate 10).

The Porto Morada variety has medium sized leaves of elongated shape, with shoulders; the veins are red. The stem is green, reddening with age, and growth is bunchy. The tuber is large, with a smooth, light pink to red skin; the flesh is yellow, of excellent flavour and somewhat dry in texture. It is a late-season variety and crops well. This variety has the habit of forming tubers some distance away from the parent plant, which makes it awkward for digging at harvest, but the variety is suitable for grazing by pigs.

Planting.

The soil for sweet potatoes should be well prepared to ensure a weed-free seed-bed. Planting material consists of cuttings, each about 15 inches long, from the nursery plot. A suitable distance for planting on most soils is three feet apart in the row and four feet between the rows. With this rate of planting 3,630 cuttings per acre would be required. Where the sweet potatoes are to be harvested by hand, the most suitable method of planting is on ridges. The cuttings can be dibbled in along the surface of the ridge, or the cuttings can be placed the correct distance apart along the top of the ridge and pressed into the soft moist ground with a blunt board, the pressure being put on the middle of the cutting. The latter method is quicker than dibbling or planting with a spade. Where large areas are to be planted the quickest method of planting is by ploughing-in the cuttings when the ground is getting its final ploughing.

A method for large scale planting which has been practised successfully by a grower at Rossmoya is to employ three or four men, a tractor and a three-furrow disc plough. One or two men are fully occupied cutting vines, one man drives the tractor and a man sitting on the plough drops plants along the plough furrow. The plants are dropped about two feet apart in the last furrow of every second run of the plough, leaving a distance of approximately six feet between the rows. Upwards of 8 acres per day have been planted in this manner.

Cultivation.

The only cultivation necessary is to check weed growth until the vines commence to run. In well prepared land it is seldom that more than one cultivation is required.

Ratooning.

A common practice where sweet potatoes are grown for grazing by pigs is to have a first-season crop and one or more ratoon crops on the same land. Experience is required in determining when a paddock has been sufficiently grazed. If a paddock is over-grazed, insufficient tubers will be left in the ground to start the following crop, and a light crop will result. In preparation for the ratoon crop, the field is well harrowed down at the end of the winter after grazing, and is then allowed to remain undisturbed until there is sufficient soil moisture to start growth of the tubers left in the ground. When the plants are well grown the field is again grazed.

Harvesting.

To ascertain whether the crop is ripe and fit to dig, a tuber should be cut in two; if ripe the cut surface will dry clear according to the colour, if unripe it will dry a dark or greenish colour. With most types of sweet potatoes, where harvesting for market it is not possible to plough out because of the risk of damaging a large percentage of the tubers. The most suitable method of digging is with a long-pronged garden fork. To assist in digging the tubers the vines should be cut first and removed from the field.

Grazing by Pigs.

Where the sweet potato crop is to be used for grazing by pigs, the paddocks should be subdivided into conveniently sized areas and the pigs allowed to do their own harvesting. If the sub-divisions are too large a good deal of waste may occur. A suitable fence for holding pigs on sweet potatoes can be made with four barbed wires. The first wire is placed six inches from the ground, the second nine inches above that, the third nine inches from the second and the top wire 18 inches above the third wire. If the field is not over-crowded and sufficient tubers are present under the vines, the pigs rarely attempt to force their way through the fence.

One big grower has paddocks approximately 25 acres in size, his boundary fences consisting of a three-wire fence, with 24-inch, 17 gauge, 3-inch mesh wire netting attached. He has found this type of fence quite suitable for the purpose and it is reasonably cheap. The pigs are turned into the crop at about the weaner stage to do their own harvesting. A feed supplement of grain sorghum is fed at the rate of 1½ lb. per pig per day and the animals are also allowed free access to hoppers containing meatmeal. No special topping off is carried out. The pigs are mustered occasionally from the paddocks and those fit for sale picked out.

The number of pigs that a field of sweet potatoes can carry will depend, of course, on the weight of tubers available in the crop. In the central district a safe margin to work on is from three to four pigs per acre on a fairly well-grown crop.

Pests.

The main pest of the sweet potato is the sweet potato weevil. Though the beetles attack the leaves, stems and tubers, the main source of loss is damage to the tubers by the larvae, which are stout, white legless grubs about one-third of an inch long. Tubers may be rendered valueless by the burrowing of the larvae.

As the pest is carried over from one season to another in tubers and vines, it is essential to clean up an infested area after harvesting. This is done by collecting all infested material and destroying it, as well as eliminating volunteer plants. Planting material should be carefully examined for signs of infestation, and it is a good idea to have the propagation bed well removed from the paddock to be planted.

Thorough cultivation of the land prior to planting and during the early stages of growth, to produce a fine tilth, will increase the vigour of the plants and will also afford some protection to the root tissues against early attack. Insecticides, such as lead arsenate, are useful against this pest only where the beetles are feeding on the leaves and stems. When tubers are infested it is not practicable to kill the larvae.

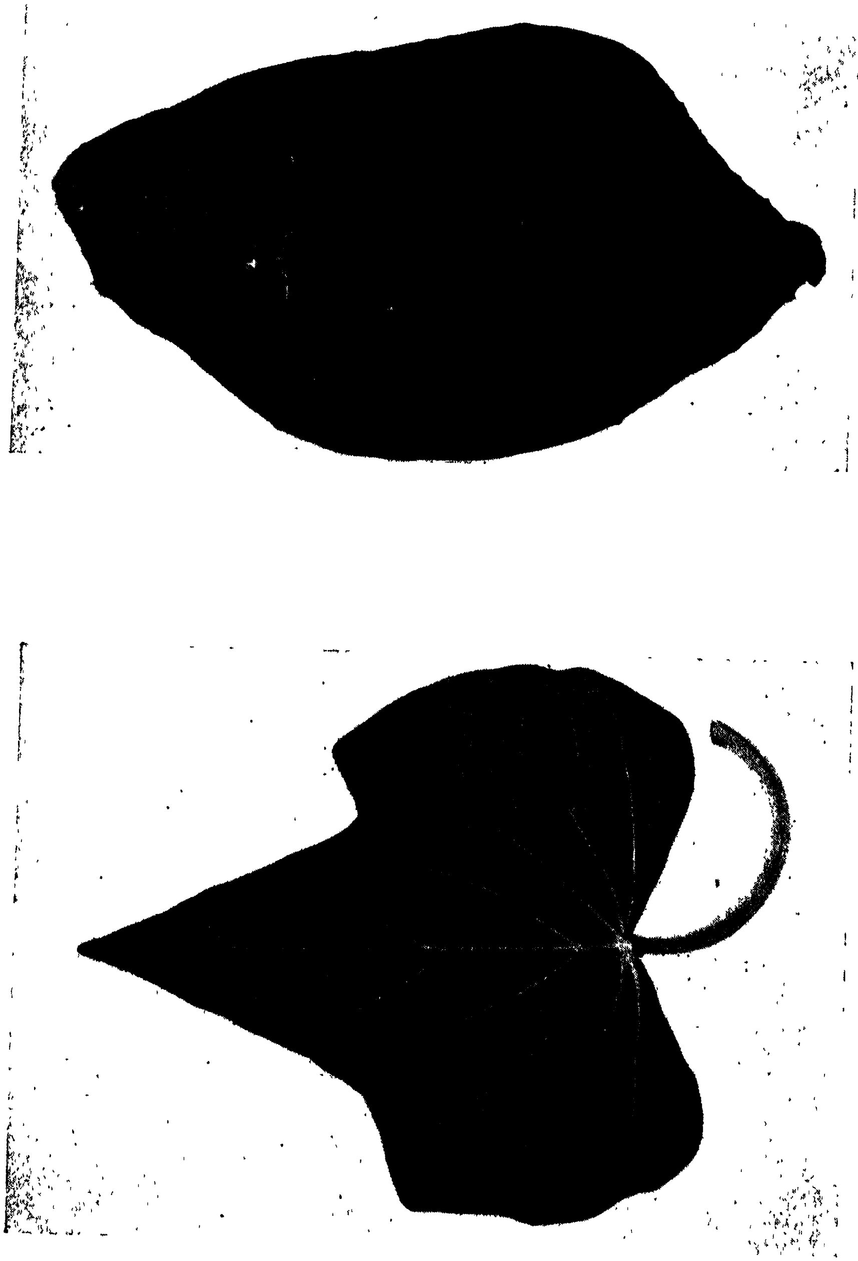

Plate 1.

ABUNDANCE.—Tuber about 7 inches long.

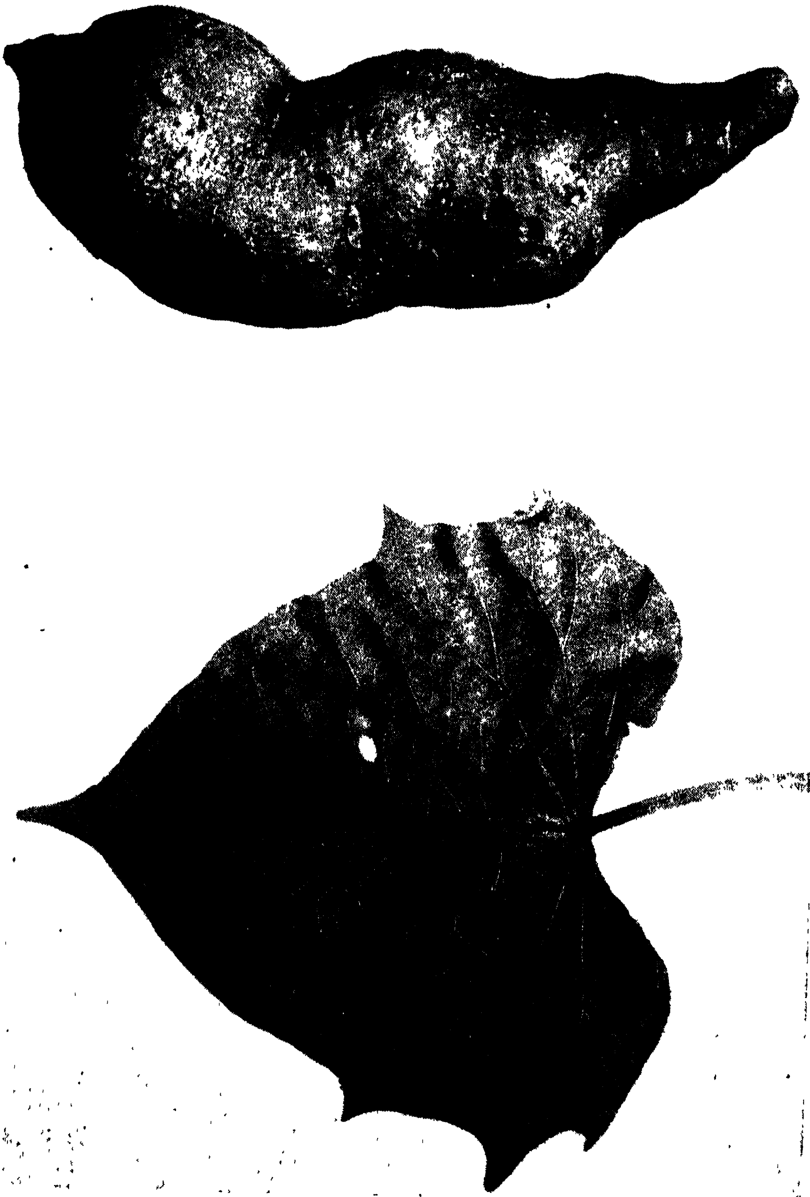

Plate 2.
ALTON DOWNS RED.—Tuber about 7½ inches long.

Plate 3.

BROOKS' GEM.—Tuber about 7½ inches long.

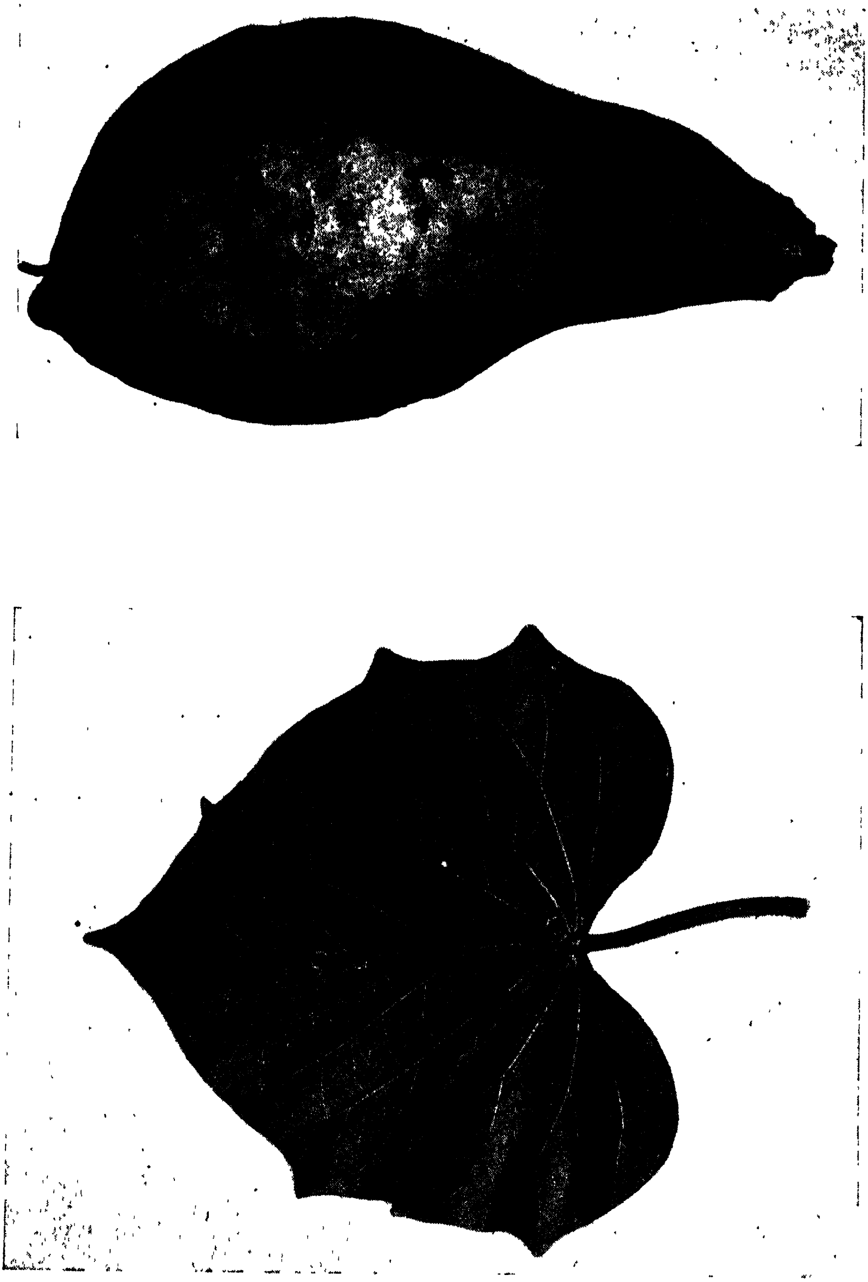

Plate 4.
LOUISIANA No. 9.—Tuber about 7¾ inches long.

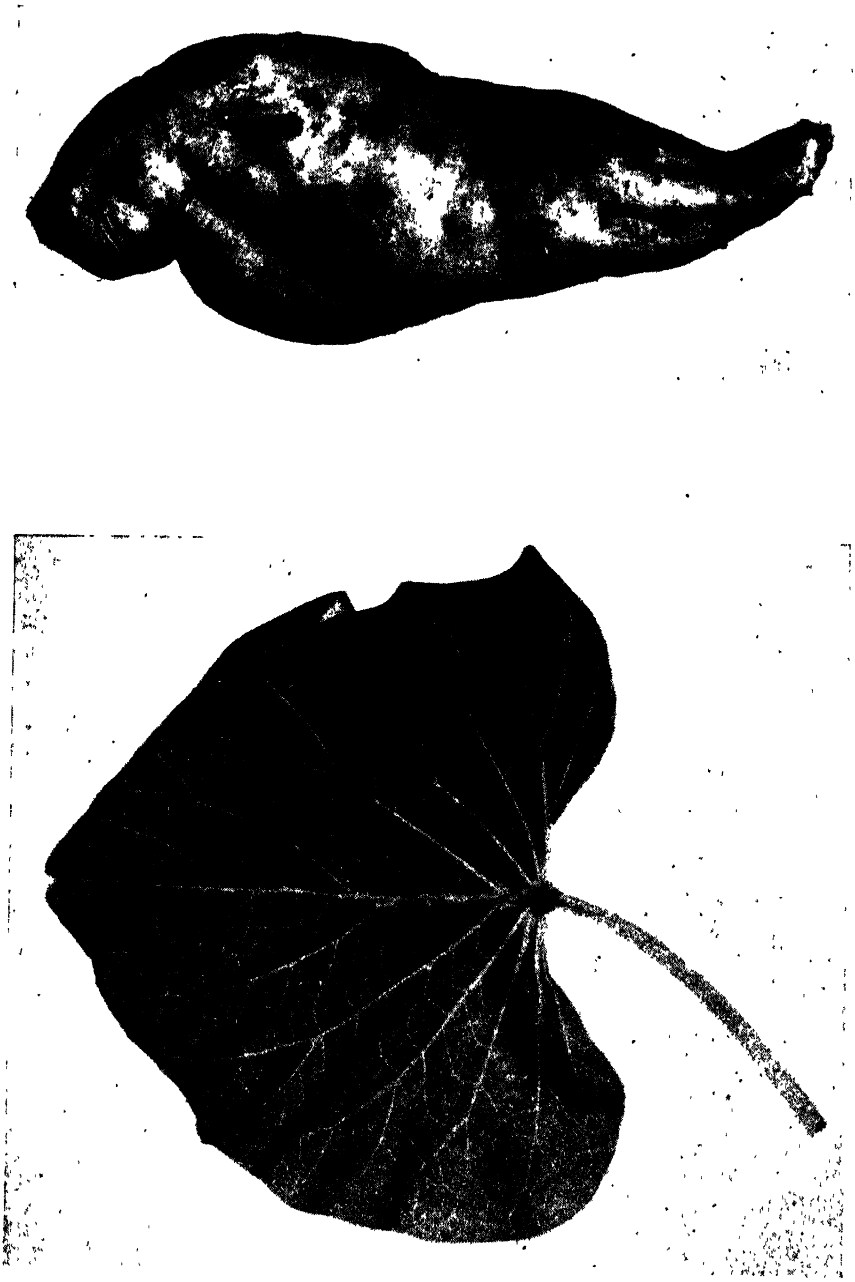

Plate 5.
NANCY GOLD.—Tuber about 8 inches long.

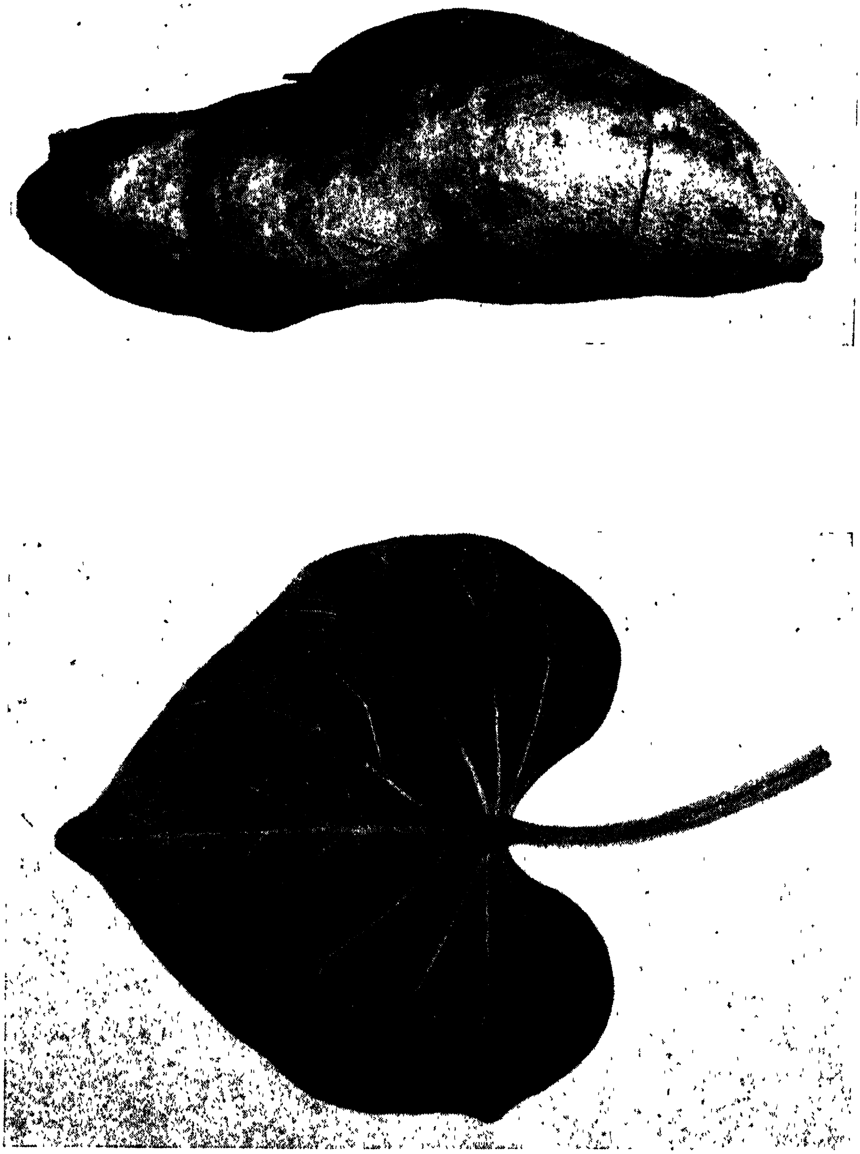

Plate 6.
NANCY HALL.—Tuber about 7½ inches long.

Plate 7.

PORTO MORADA.—Tuber about $6\frac{3}{4}$ inches long.

Plate 8.
PORTO RICO (BUNCH).—Tuber about 6 inches long.

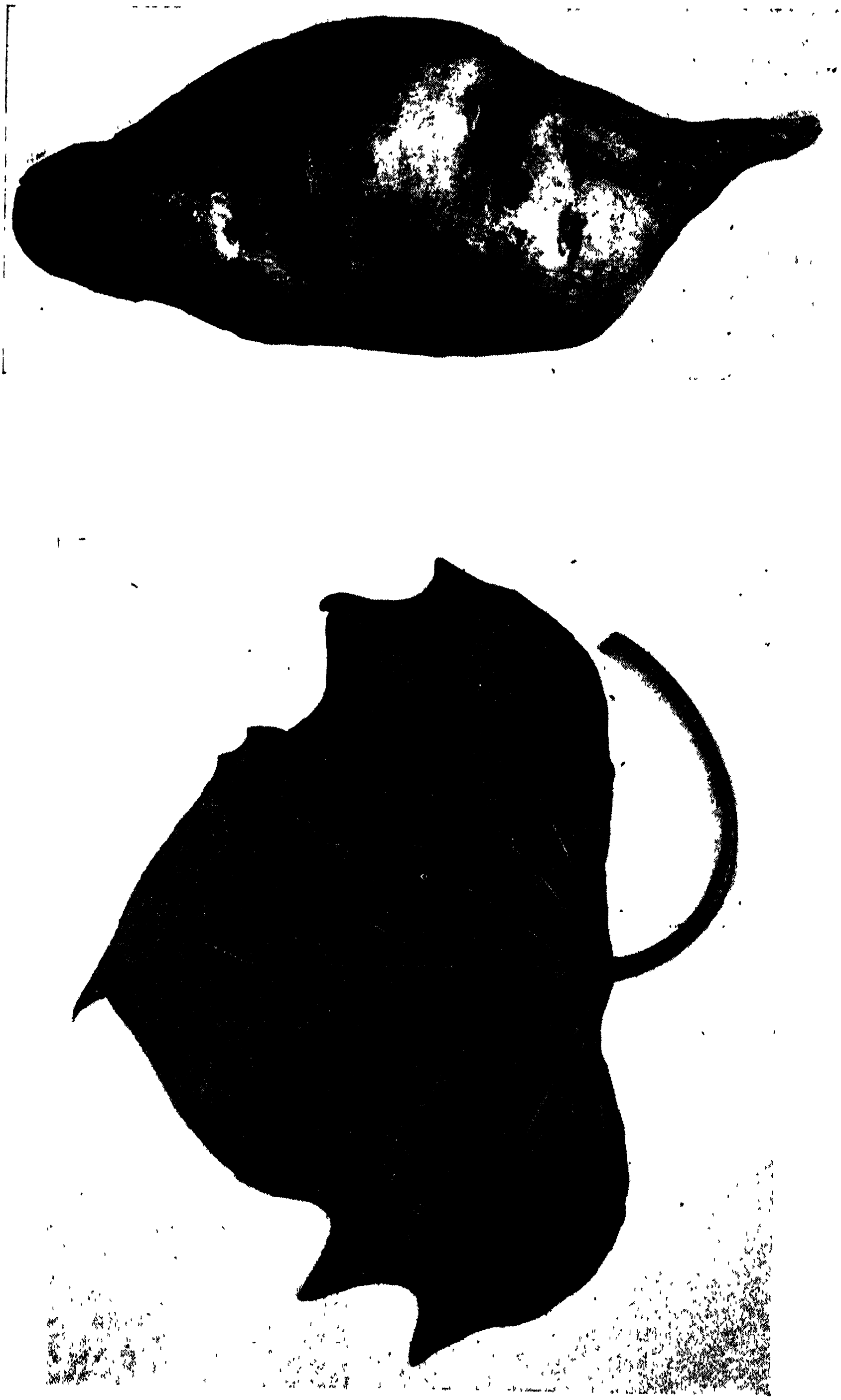

Plate 9.
PORTO RICO (UNIT 7).—Tuber about 8 inches long.

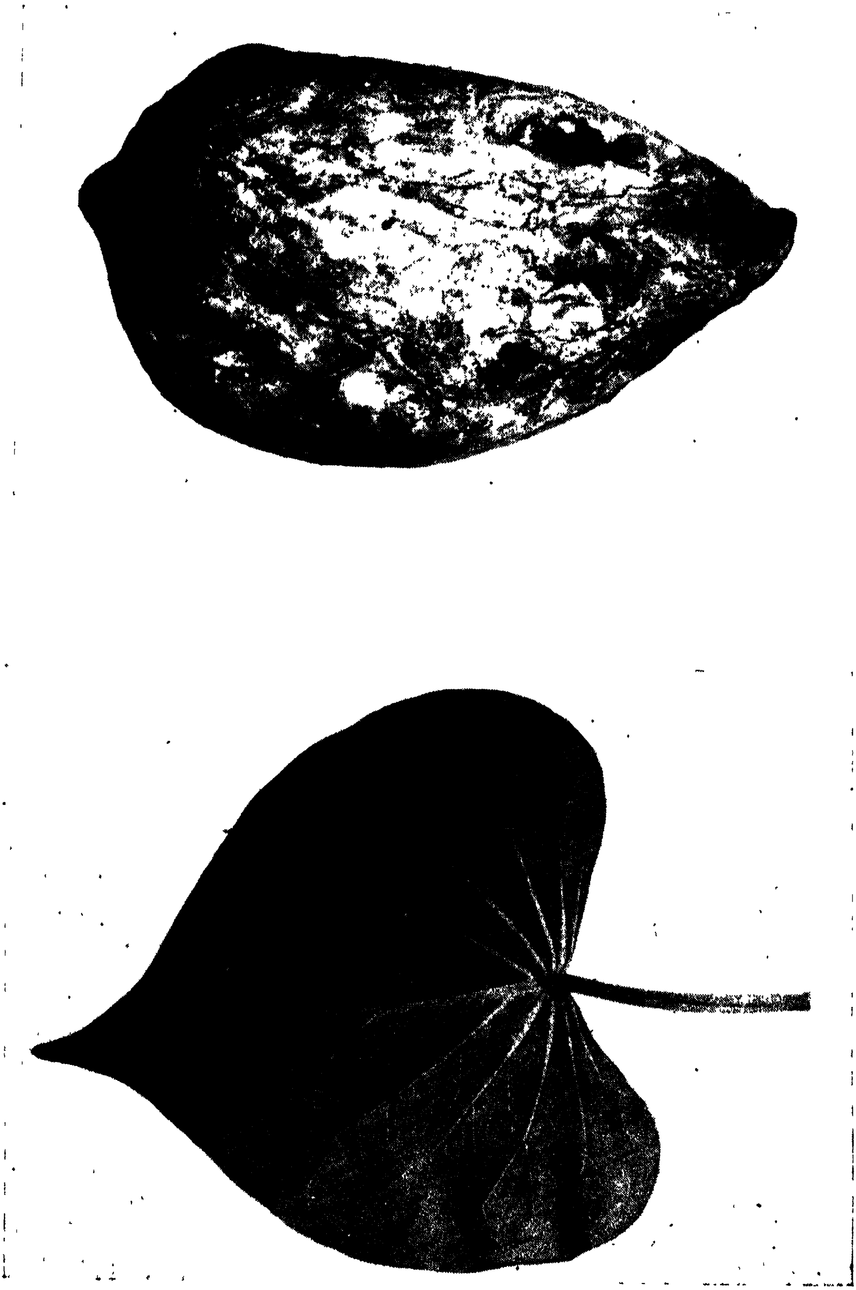

Plate 10.
WHITE MALTESE.—Tuber about 5½ inches long.

Strawberry Growing.

APPROVED PLANTING MATERIAL.

THE scheme for approved strawberry runners was initiated in 1947 with a view to reducing the incidence of strawberry virus diseases and to improve the quality of strawberry planting material generally. In 1948, a large number of growers submitted their crops for examination and, after a series of inspections, the crops of the following growers have satisfied the requirements of the strawberry-runner scheme which were published in the *Queensland Agricultural Journal* for April, 1948. Therefore, these growers may now sell their runners as "approved by the Department of Agriculture and Stock."

W. A. Wood, Image Flat road, Nambour.

G. A. Armstrong, Montville road, Palmwoods.

M. L. Spackman, Palmwoods.

F. L. Rasmussen, Maroochydore road, Woombye.

T. E. Kidd, Buderim, via Woombye.

H. V. Langevad and L. Green, "Valhalla," Mains road, Sunnybank.

E. E. Couchman, Musgrave road, Cooper's Plains.

G. H. Lambly, Birkdale.

D. J. Brown, Wellington street, Cleveland.

L. H. Keating, Pinklands, via Cleveland.

C. A. Kempnich, Pinklands, via Cleveland.

G. E. Lax, Redland Bay road, Pinklands, via Cleveland.

A. H. Pateman, Pinklands, via Cleveland.

PLANT PROTECTION

Diseases of Pome Fruit in the Stanthorpe District.

R. B. MORWOOD, Senior Pathologist, Science Branch.

POME fruits, which include apples, pears and quinces, are practically restricted in Queensland to the Stanthorpe area on the high southern border of the State. Even in that district they are subjected to higher summer temperatures than are desirable and generally experience a dry spring period. These factors result in a different disease situation than occurs elsewhere. In the southern States and most overseas apple-growing areas orchardists have to contend with apple scab and other diseases caused by parasitic fungi which rely on humid conditions. At Stanthorpe the emphasis is on powdery mildew, caused by a fungus which thrives in moderately dry weather, and on physiological diseases which are the result of adverse conditions rather than attack by parasites.

Powdery Mildew.

This disease appears as a white powdery coating on the surface of leaves, particularly affecting the group of young leaves surrounding a developing bud. Leaves tend to curl and become contorted, the affected areas later drying out to a condition known as scorch, in which stage the disease resembles spray injury. When a bud is thickly coated with mildew it fails to develop fully and, as the season advances, such buds and twigs dry out and die back (Plate 11). Leaf scorch, defoliation and twig dieback result in a general decline of the tree, with reduction in the production of fruit and general unthriftiness. These effects are more severe on trees which are in poor condition for other reasons, such as neglect of cultural operations.

The mildew consists of the minute threads and spores of a fungous parasite.* Like the organisms causing other powdery mildews it differs from the majority of parasitic fungi in developing on the outside of the host. This should make control simple, but actually the fungus is difficult to deal with in the dormant season as at that stage the fungus penetrates between the undeveloped leaves in the bud. From such initial sources of infection the fungus develops with the bud and infests the resultant leaves. It then produces countless spores which blow about to produce new infections.

The control of powdery mildew commences with the removal of obviously affected twigs when pruning. There will still be a number of infections escape, so that it will be necessary to use sulphur sprays to deal with the subsequent spread. Removal of badly affected laterals could be continued during the summer with advantage, particularly on lightly affected trees.

* *Podosphaera leucotricha* (Ell. & Everh.) Salm.

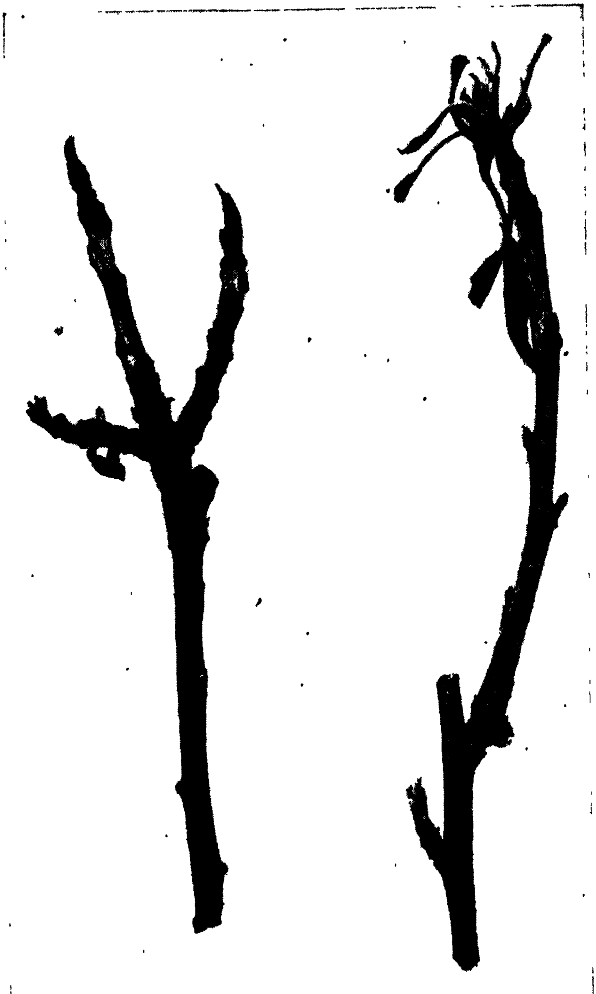

Plate 11.
POWDERY MILDEW OF THE APPLE.—Note the white fungal growth and resulting dieback.

At the pink stage all susceptible trees should be sprayed with lime sulphur, 1 in 30. This should be followed by the use of wettable sulphur (5 lb. 100 gallons) after the fruit has set. The number of sprayings will vary with the severity of the disease, as many as four being necessary in some cases at intervals of three weeks. For economy these should be combined as far as possible with codling moth cover sprays. Varieties of apples vary in their susceptibility to powdery mildew to such an extent that it is frequently regarded by orchardists as a disease of Jonathans only. The Rome Beauty variety is equally susceptible, with Gravenstein and Kirk David somewhat less so. Granny Smith trees are normally practically immune, but have been known to carry a fair degree of infection when adjacent to neglected Jonathan trees.

Black Spot or Scab.

This disease is the most severe trouble of apples in other areas but it is kept in control by unsuitable climatic conditions at Stanthorpe and is seldom encountered. The disease, which is characterised by scabby blemishes on the fruit, is caused by a fungus* which also produces a leaf spot. The corresponding disease on pears, caused by a closely related fungus,† is unfortunately able to survive at Stanthorpe and requires the application of control measures. It appears as black spots on the young leaves, fruit and small twigs. Control is readily obtained by the use of copper sprays, but some compromise is necessary as sprays applied after fruit set tend to produce russet.

All fallen leaves should be ploughed under or buried by digging, infected prunings burned, and the following spray schedule used:

(*a*) At green tip, Bordeaux mixture 6-4-40;

(*b*) At open cluster, Bordeaux mixture 2-3-40;

(*c*) At calyx stage, Bordeaux mixture 2-3-40.

Prepared copper sprays may be substituted for Bordeaux mixture. Application (c) may be omitted if the disease is not severe.

Armillaria Root Rot.

Trees affected with this disease first show a general unthriftiness and slow decline, which may extend for several years before the trees succumb to its effects. Naturally these symptoms can easily be confused with those of trees showing poor growth from other causes, but armillaria root rot can be readily distinguished by examination of the roots. The long strands of the fungus‡ concerned, resembling black bootlaces, can be easily seen on affected roots (Plate 12). These serve to spread the fungus along roots or from root to root. From these minute fungal threads then penetrate the root and set up decay. When rotting affects many main roots or the base of the trunk, the severe effects of the disease can be seen in the starved aboveground parts.

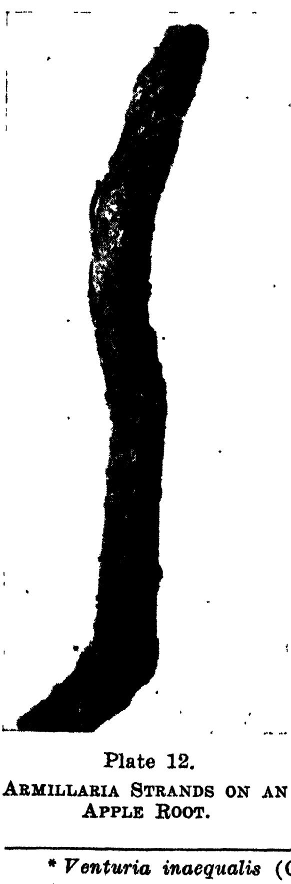

Plate 12.
ARMILLARIA STRANDS ON AN APPLE ROOT.

The fungus under certain conditions produces mushroom-like fruiting bodies above affected roots, but the spores from these are not the usual method of spreading the fungus. Armillaria, as it is generally known to orchardists, is found on the roots of native trees and it is from the remains of these left on clearing that it spreads to the orchard trees.

The control of armillaria consists primarily of good clearing, including the careful removal of stumps and all roots. Affected trees should have their root systems opened to the air by the removal of soil from around the crown and main roots. This should be

* *Venturia inaequalis* (Cooke) Wint.

† *V. pirina* Aderh.

‡ *Armillaria mellea* (Vahl) Fr.

sufficient to check the spread of the fungus, but as an added precaution the exposed portions may be treated with Bordeaux mixture. Severely affected trees should not be expected to recover. Soil fumigants such as carbon bisulphide have been suggested for use against armillaria but are cumbersome to use. More recently thiuram disulphide derivatives, sometimes known as T.D.M.S., have been suggested but no details are available on their performance.

Plate 13.
CANKER OF THE APPLE.

Canker.

True cankers on apple trees consist of fungus infections of the leaders or longer laterals which result in dry cracked bark, frequently with a concentric pattern (Plate 13). The death of all leaders beyond this point follows the interference with the sap flow. A considerable number of different fungi* can produce canker in apples They gain entrance through large pruning cuts or breaks in the limbs. As a precautionary measure, tar or a bitumen seal should be applied to all such injuries. Cankers which may be present on the tree should be cut out well below any sign of visible infection and the cut treated. If the main limb or the crotch is affected, this involves destruction of the tree. All infected parts should be destroyed by burning promptly.

* *Physalospora obtusa* (Schw.) Cooke is the most common in Queensland.

Gravenstein Gnarl.

This disease, which is frequently known to orchardists as canker, differs from true canker in that it is not caused by any known parasite and it does not involve any break or cut in the bark of the tree. It is confined to the Gravenstein variety and appears as irregular outgrowths alternating with sunken areas on the main trunk or leaders. When the growth becomes sufficiently irregular, death of one or more leaders results. There is no known cure but the severest effects of gnarl can be avoided by high-working Gravenstein on to the main framework of a tree of some other variety.

Wood Rot.

This is a disease of a similar type to canker in that it is caused by fungi* which invade large wounds. It differs from it only in that the heart wood is the seat of injury rather than the bark. The fungi concerned produce fruiting bodies in the form of brackets on the surface of affected trees. These produce numerous wind-borne spores which affect unprotected cut surfaces of the wood. This is liable to cause trouble when grafting, but with adequate care in covering the exposed wood losses are small. Control measures are the same as for canker.

Fruit Rot.

Pome fruits are liable to a large number of fruit rots, but these are known more as storage troubles than as orchard conditions. However, soft rot,† bitter rot‡ and brown rot§ may appear while the fruit is still on the tree, particularly in a wet season. With good cultural methods, careful handling of fruit and correct storage conditions, fruit losses from any of these causes should be slight.

Dieback.

Dieback is a symptom of several tree diseases rather than a specific disease. The term includes any decline of the tree which involves death of leaders or laterals from the tips downwards. Powdery mildew and armillaria root rot, to which reference has already been made, can produce dieback, but it may also be caused by bad drainage and a variety of other causes. It is one symptom of some deficiency diseases. When all the known causes of dieback are eliminated there still remains a type or dieback of the apple which cannot be explained and which appears to be bound up with still unsolved problems of nutrition of the apple tree.

Deficiency Diseases.

The apple tree in the Stanthorpe district appears to be particularly subject to diseases due to minor element deficiencies. These include little leaf (zinc deficiency) summer dieback (copper deficiency) and measles (boron deficiency). Departmental pamphlets dealing with these conditions are available.

Sour Sap.

Young trees soon after budburst in the spring are liable to a sudden cessation of development. On cutting through the bark of affected trees, a smell can be detected which has given rise to the name sour

* *Polystictus versicolor* (L.) Fr. and *Schizophyllum commune* Fr.

† *Penicillium expansum* Thom.

‡ *Glomerella cingulata* (Stonem.) Spauld and v. Schrenk.

§ *Sclerotinia fructicola* (Wint.) Rehm.

sap. This disease is not fully understood, but making a number of vertical cuts through the bark and cambium will, if carried out promptly after the first onset of the symptoms, generally result in a renewal of normal growth.

Fabraea Scald.

This disease is due to a fungus* which causes a dark spotting of leaves and fruit and is found principally on quinces. In wet seasons it can be so severe on that host that little marketable fruit can be picked. When fruit is infected early the black spots became corky and the fruit is stunted and distorted. The use of copper sprays in a schedule similar to that for black spot of the pear should be effective whenever it is found desirable to apply control measures.

* *Fabraea maculata Atk.*

QUEENSLAND SHOW DATES.*

Allora	February 23-24	Laidley	July 8-9
Beaudesert	May 6-7	Lowood	June 10-13
Beenleigh	September 16-17	Mackay	June 28-30
Boonah	June 3-4	Maleny	May 12-13
Brisbane R.N.A.	August 6-13	Marburg	May 13-14
Bundaberg	June 9-11	Maryborough	June 2-4
Charleville	May 18-19	Miles	April 12-13
Chinchilla	April 7-9	Millmerran	March 1-2
Clifton	February 18-19	Murgon	May 19-21
Cooyar	March 12	Nambour	July 7-9
Crow's Nest	May 27-28	Nanango	April 28-30
Dalby	March 31-April 2	Oakey	March 4-5
Esk	July 1-2	Pittsworth	March 8-9
Gatton	July 21-23	Redlands	July 15-16
Gin Gin	June 13-14	Rockhampton	June 22-25
Goombungee	May 21	Roma	May 4-5
Goomeri	May 24-25	Rosewood	July 15-16
Goondiwindi	April 30-May 2	Stanthorpe	February 3-5
Gympie	May 26-28	Tara	March 29-30
Inglewood	March 11-12	Toogoolawah	June 17-18
Ipswich	May 17-19	Toowoomba	March 19-24
Jandowae	April 4-5	Wallumbilla	April 29-30
Kalbar	May 28	Warrill View	May 21
Kilcoy	June 24-25	Warwick	February 10-12
Kilkivan	June 10-11	Wondai	May 12-14
Killarney	February 25-26	Woodford	July 15-16
Kingaroy	May 5-7	Yarraman	April 22-23

* This list is not necessarily complete, and any further show dates will be published in future issues.

Watch For These Weeds!

SOUTH Coast dairy farmers in valleys running down from the Macpherson Range, as well as those on the Springbrook plateau, have been troubled for some years past by two weeds closely related botanically but of different appearance, one being of upright habit and the other somewhat straggling.

Both occur to a slight extent elsewhere in coastal dairying areas, such as the Pine and Stanley watersheds and in the Brisbane district

These two weeds are known by such names as Crofton weed, hemp agrimony, mist-flower and whitetop. The suggested standard common name for the upright species* is sticky agrimony and that for the other species† is mist-flower.

Sticky Agrimony.

Sticky agrimony (Plate 14) usually grows from four to six feet high and the plant has numerous upright stems with leaves 2 to 3 inches long and up to 2 inches broad at the base. The flowers are in heads very much like those of the common billygoat weed (Ageratum), except that they are white and not blue.

Mist-flower.

The straggling species (Plate 15) has white flowers very similar to those of sticky agrimony, but the leaves are of a different shape and the stems are not usually upright but straggle to some extent and root at their lower joints. The plants usually do not exceed two feet in height.

Where to Look.

Both of these weeds appear to establish first along watercourses or on shaded scrub edges, from which they spread into pastures. Coastal dairy farmers from Maleny to the border should keep a close watch for the first appearance of these weeds on their properties. They are most easily identified when in flower about August, and any plants discovered should be dug out before they seed.

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* *Eupatorium adenophorum.*

† *Eupatorium riparium.*

Plate 14.

STICKY AGRIMONY.—Plant up to 6 feet tall; flowers white, in heads like those of billygoat weed. Usually flowers in August.

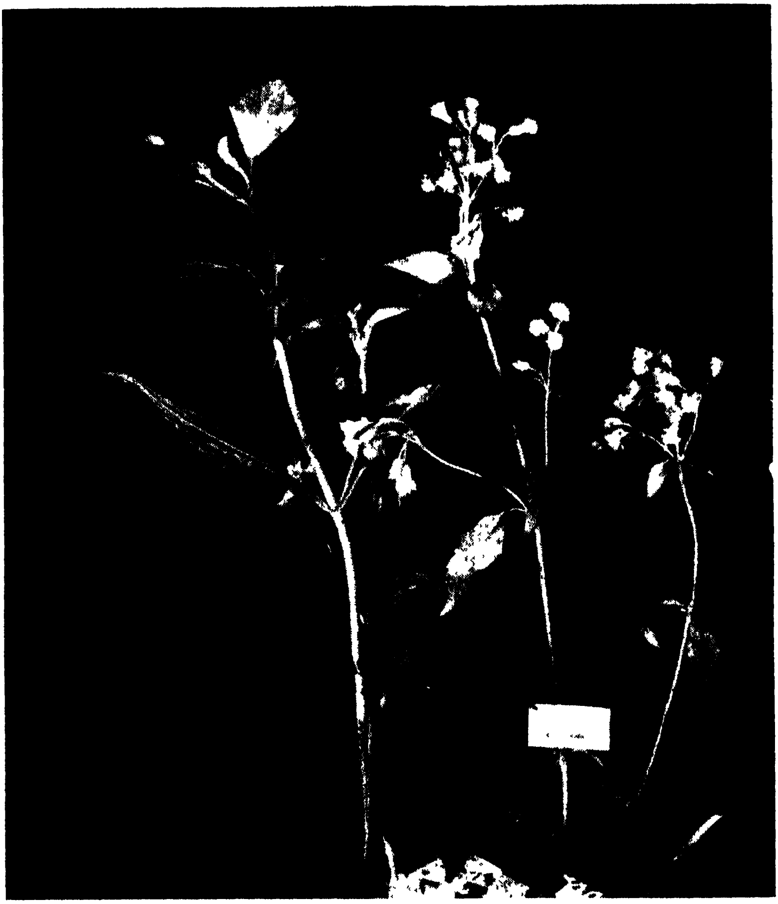


Plate 15.

MIST-FLOWER.—Straggling plant up to 2 feet high; flowers white, in heads like those of billygoat weed. Usually flowers in August.

Control Measures.

No satisfactory control measures for heavy infestations can yet be recommended. There is some prospect of at least one of the hormone weedkillers being of use in control work. There are a few of these weedkillers on the market in packages costing from three to six shillings, and with these farmers can conduct experimental sprayings at little cost. The plants should be brushed and the regrowth sprayed when a few weeks old.

Both arsenic pentoxide and sodium chlorate give fair kills of sticky agrimony and mist-flower, but the former is dangerous to use on pasture areas, and sodium chlorate is scarce and expensive.

Milking Bails—Crush v. Walk-through Type.

C. R. TUMMON, Dairy Adviser, Division of Dairying.

THE *Dairy Produce Acts* set out detailed instructions regarding separator room, cream room, and air space in the milking shed, but do not specifically prescribe any type of bails. This gives the farmer some option in the choice of bails. It is the purpose of this paper to point out the advantages of the double-type walk-through bails over crush bails.

The types of milking bails in use throughout Queensland vary considerably. The older types consist mainly of the head-locking bails, or combination feeding stalls and milking bails. With each of these types the animals have to "backed out" after milking, which causes unnecessary delay and confusion. These types are no longer popular and will gradually be eliminated as old buildings are replaced with new.

Various forms of race, crush or echelon type bails were at one time popular in certain districts and a few of these bails are still being constructed. Their construction is to be discouraged as their disadvantages far outweigh their advantages.

Claims Examined.

The advantages claimed by the crush-type bail are—

(*a*) *Simplicity of erection and reduction of cost.*—They may be cheaper, as most crush bails have open sides and consequently do not require side walls. However, this is a doubtful advantage, as neither the cows nor the milkers are protected from the weather during milking. If the sides are walled in, then the cost of this type of shed varies little from the double type of walk-through bail.

(*b*) *Milking can be carried out at a faster rate.*—Admittedly, a crush full of cattle may be yarded at the one time, thus avoiding bailing up of individual cows. However, as the first cow in the crush cannot be let out until the last one on the same side is milked, and as cows cannot be milked faster than the machines are capable of withdrawing the milk, it is difficult to see how faster milking can be obtained, provided there is uninterrupted milking, with either crush or walk-through bails. Usually with walk-through bails cows become accustomed to the order in which they are milked and little difficulty is experienced in bailing-up.

(*c*) *Breaking-in of heifers is facilitated.*—The use of a crush is certainly a good way of breaking in a wild heifer, but well-constructed walk-through bails are quite capable of doing the job. In any case, a separate crush could be erected for many uses on a farm, including the breaking-in of heifers. It should be remembered, however, that if calves are well handled, bucket fed, and kindly treated when young (as they should be on a well-managed farm), the breaking-in after calving presents no difficulty.

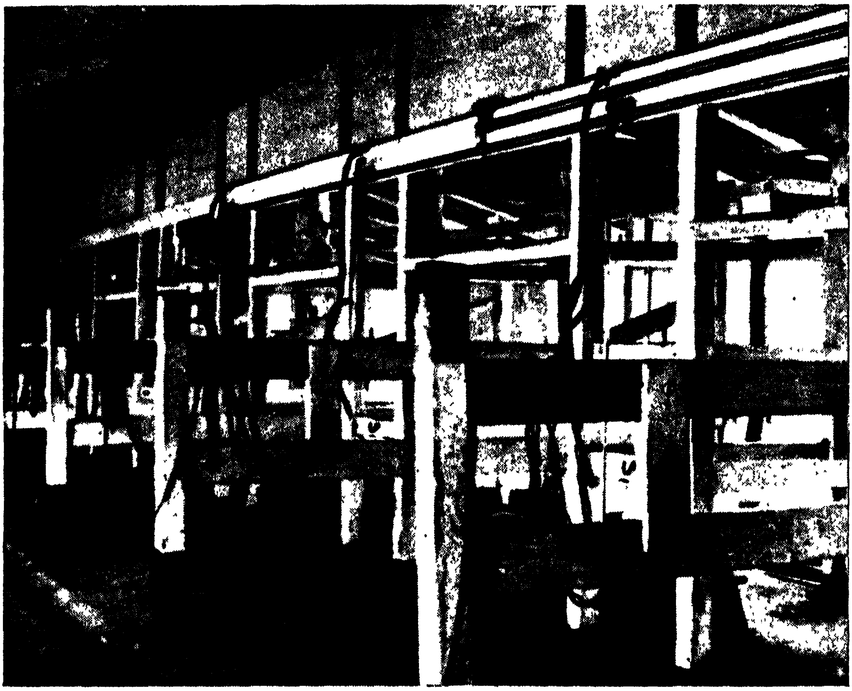


Plate 16.
SOUNDLY CONSTRUCTED "WALK-THROUGH" BAILS.

Disadvantages of Crush Type.

Now that the advantages claimed for the crush type of bail have been reveiwed, it is desired to point out the disadvantages. They are:—

(a) *Difficulty in hand feeding.*—Admittedly it is not the best practice to hand-feed cows in milking bails, and separate feeding stalls should be provided. However, most farmers know that when cows are fed in outside stalls, they are inclined to be somewhat fidgety in the bails whether fed before or after milking. Therefore, the feeding of a little concentrate in the bails prevents cows from "holding-up" their milk. It is an easy matter to hand-feed this small quantity of concentrate in the walk-through type of bail but it is well-nigh impossible to do so with the crush type.

(b) *Danger from kicking.*—There is much more danger of the milker being kicked in the crush bails as the bottom rail is about 2 feet 6 inches off the floor and no provision can be made for leg-roping. It is realised that in most cases leg-roping is an undesirable practice, but it is necessary with some animals.

(c) *Upsetting of cows with consequent "holding-up" of milk.*—With crush bails, if one animal is nervous and upset she can move about and upset the whole crush-full, causing a "hold-up" in milk of all the cows concerned.

(*d*) *Difficulty in handling individual cows.*—Probably this is the most important reason of all. It is known that cows respond to kind treatment and individual handling and this cannot be achieved so successfully in the crush type of bail. Additionally, if a cow has a bail to herself it is an easy matter to treat her for any particular ailment at milking time

(*e*) *General appearance.*—The general appearance of crush bails, being more of a skeleton type, compares unfavourably with the approved walk-through type which can be nicely painted and made to look a wholesome place for the production of milk.

(*f*) *Difficulty in cleaning.*—The two lines of rails down the middle of the building make it difficult to clean crush bails, and often the manure is merely pushed to either side until an undesirable heap accumulates.

(*g*) *The movement of milkers is hampered.*—Milkers are hampered as they have to work in the centre passage where milk lines extend from the centre overhead to either side.

(*h*) *Non-compliance with the Act in some cases.*—In some cases where crush bails are erected they do not comply with the Act, inasmuch as the exit space at the head of the crush is regarded as the air space required and the engine and pump are then placed in the separator room, whereas an additional air space of six feet should be provided to house such engine and pump.

From the foregoing it is hoped farmers will be discouraged from building any crush-type bails. Farmers contemplating the erection of new milking sheds are strongly advised to discuss the site, drainage and kind of building with the local dairy officer, whose advice and experience are always at their disposal. Moreover, this will avoid any risk of alterations having to be made to buildings to enable them to comply with the Act.

DEVELOPMENT OF GRAZING LANDS.

The Bureau of Investigation under *The Land and Water Resources Development Acts*, 1943 *to* 1946, in its last annual report emphasises that expansion of production in the extensive pastoral areas of the State can only be obtained by developing existing holdings, since there is very little suitable pastoral country not now occupied.

The three main developmental factors are set out as:—

(1) Substantial improvements in fencing and water facilities to assist better management on individual holdings;

(2) Cultivation of fertile areas in the reasonably good rainfall belt; and

(3) Irrigation, where feasible.

The Bureau is co-operating with the Department of Agriculture and Stock and the Department of Irrigation and Water Supply in testing of pastures and fodder crops under irrigation.

DIVISION OF DAIRYING.

GROUP HERD RECORDING SCHEME.

SUMMARY OF HERD RECORDING UNITS FOR NOVEMBER, 1948.

District.	No. of Herds in Group.	No of Cows in Group	Daily Average for all Cows in Group			Average of Highest Herd in Group.		
			Milk Lb	Test Per Cent	Fat. Lb	Milk. Lb.	Test Per Cent.	Fat. Lb.
Beaudesert . .	17	818	15 2	4·06	·618	21·1	4·71	·995
Maleny, No. 1	19	806	13·87	4·45	·617	18 4	5·13	·943
Maleny, No. 2 . .	15	664	13 3	4·48	·596	26·76	4·71	1·262
Oakey, No. 1 .. .	22	722	17·01	4 26	·724	23·22	5·27	1·223
Oakey, No. 2 .. .	22	715	17·81	4·1	73	28 81	3 72	1·073
Allora	13	348	19·06	4·31	·822	30·5	3·97	1·21
Goomeri	18	628	13·21	3 97	·524	17·34	4·37	·758
Cooroy, No. 1 . ..	22	746	10 82	3 92	·424	24·25	3·93	·954
Cooroy, No. 2	21	601	9·28	3·8	·353	13 5	3·3	·445
Kingaroy, No. 1	20	712	14·97	3·86	·578	26·91	4·09	1·101
Kingaroy, No. 2	19	678	13·95	3·69	·514	18·14	3·78	·687
Cedar Pocket	21	539	12·9	4·01	·518	19·58	4·39	·859
Monto	21	708	17·55	4 07	·714	28 8	3·64	1·05
Pomona	19	699	10 58	3·85	·407	17·1	4·04	·69
Miva-Theebine . ..	17	661	9·25	3·96	·366	15·99	4·26	·68
Warwick	21	685	21·35	3·81	·814	30·05	4·04	1·214
Kenilworth	18	741	13·65	3·95	·539	26·12	3·43	·897
Killarney	19	796	17·8	4·12	·733	19·9	4·88	·971
Toogoolawah	16	723	13·53	3·78	·511	22·09	3·74	·826
Toowoomba, No. 1 ..	24	750	14·71	4·18	·614	19·44	4·35	·846
Toowoomba, No. 2 ..	13	603	14·83	3·93	·583	26·74	3·75	1·002
Malanda	22	755	14 43	3·7	·535	26·4	3·6	·951

Fat Lamb Production in Queensland.

G. R. MOULE, Officer in Charge, Sheep and Wool Branch.

(*Continued from page* 365, *December,* 1948.)

SHEEP BREEDING FOR LAMB PRODUCTION.

The Mutton Type of Sheep.

A square, blocky, low-set symmetrical appearance is typical of the mutton sheep. Associated with this in most cases is a short, broad head. As the neck is a low-priced cut it should be short and thick and should blend well into the shoulder. The shoulders should be broad and fitted evenly against well-sprung ribs. Loose, open blades and flat, long shoulders, so often associated with a peaked wither, are not popular as they are considered to indicate thinness of fleshing throughout the carcase.

It is important that the ribs be well sprung to give a broad, even back. Excessive depth of chest is not desirable, particularly when it is present at the expense of width of back. It should be remembered that the brisket and the lower extremities of the lambs are low-priced cuts, but at the same time the legs should be squarely set and the feet good.

The most valuable part of the carcase is the loin, which should be broad and thick. This thickness should come from an even covering of deep flesh. Length and depth of fleshing are not usually associated in sheep, but depth of fleshing is considered to be the more important. Accordingly, thickness and close coupling of the loin are most desirable characteristics provided they are not over-developed. This would make the sheep short and dumpy.

The rump should be well rounded at the base of the tail but otherwise broad and level and should be carried down to well-muscled thighs. The length of the rump should be sufficient to maintain symmetry and at the same time give balanced proportions for a good leg of mutton—an important and valuable cut. The meat should be carried down to wide-set straight hocks and to get this the quarter must be well turned.

Balance and symmetry in the live animal are usually associated with an ideal carcase. Coarseness, over-development, or under-development of any one part will upset the balance of the animal and detract from the value of the carcase.

The covering of flesh is an important feature of any mutton sheep. It should be firm and even and show no indication of hardness or soft, blubbery lumps. These defects are most likely to occur on the lower ribs, at the base of the tail or on the margin of the loin.

Pure Breeds.

In Queensland the sheep population is predominantly Merino. British breeds are not well established numerically and this has led to an acute shortage of suitable crossbred ewes for fat lamb mothers. Before discussing the crossbreeding policy which it is advisable to follow the breeds of sheep will be described.

Australian Merino.

With the Merino, wool is the first consideration, and because of its conformation the carcase is not particularly suitable for a high-class mutton trade. Merinos grow slowly compared with British breeds and their crosses. When they do mature they are comparatively small framed and lack depth of fleshing. Further, they do not milk as well as British sheep nor do they give the same high lambing percentages. Merinos do not adapt themselves readily to the agricultural environment in which lambs are produced and they seldom become as quiet and tractable as other breeds.

Long-woolled Breeds.

The Border Leicester.—The Border Leicester breed was developed in the "border" country about two centuries ago by pupils of the famous Robert Bakewell. It is a hardy breed of sheep and in Australia is more commonly found in the comparatively drier areas. It is used widely and to great advantage in western and north-western New South Wales and it is one of the most popular British breeds in Australia.

Border Leicesters are particularly suited for mating with Merino ewes in marginal lamb country to produce "summer" lambs and crossbred ewes for use as "sucker" lamb mothers. The half-bred ewes are particularly suitable for this purpose, as they are prolific and are good milkers and enjoy great longevity.

Plate 17 shows a ram typical of the Border Leicester breed, and the standard as laid down in the Flock Book for British Breeds of Sheep in Australia is as follows:—

Head—Medium sized, smooth crown, wide in forehead, full and even down the face to a slightly Roman nose, perfectly free from wool and covered with pure white soft hair, though occasionally a black spot will appear. Face—Strong jaw and clean cut; nostrils wide and dark. Eyes—Full and prominent, but mild and placid. Ears—Lively, mobile, medium-sized and semi-erect; white inside and out, though black spots sometimes appear with age. Neck—Tapering nicely from the head and strongly set on at the shoulders. Shoulders—Wide, with plenty of heart room. Chest—Broad, deep and well formed. Back—Straight, level and broad. Ribs—Well sprung in a fine circular arch, more attractive for width than for depth. Hindquarters—The loin should be wide and firm, and the quarters long and deep. Legs—Squarely set under, well apart, falling straight from the body, medium length, strong, with clean, flat bone, covered with perfectly white hair and quite free from

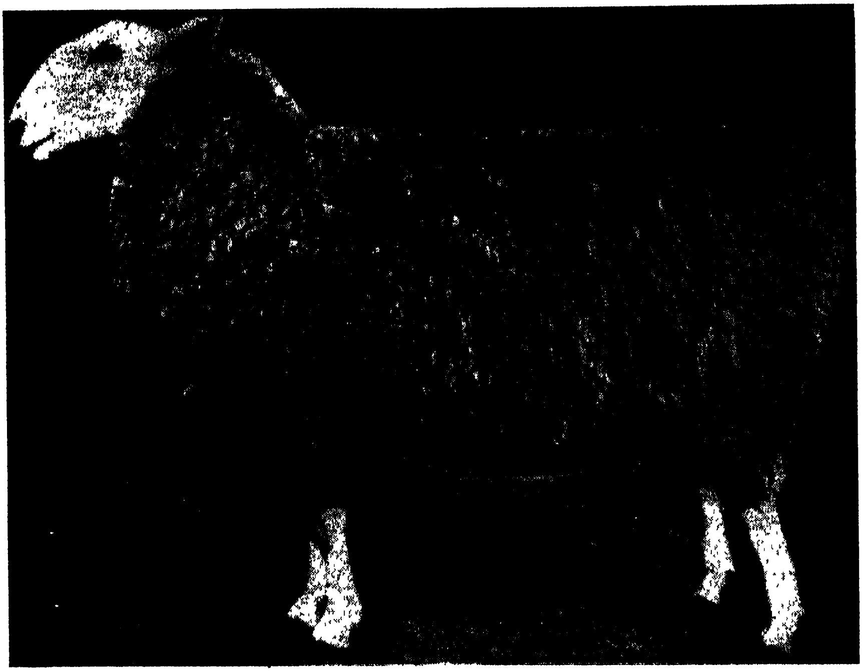


Plate 17.
A BORDER LEICESTER RAM.

wool; dark hoofs preferable. Skin—Pink and mellow to the touch. Carriage—Free and noble in appearance. Fleece—The whole body should be evenly covered with a soft-handling and lustrous wool, comparatively fine, with a staple of commanding length and with a nice undulating crimp; the latter should run right to the tip, where the fleece must show uniform curl. General appearance—The shoulders should slope gently to the ribs and thus avoid narrowness around the heart; the back should be evenly covered with flesh firm to the touch; and the underline should be almost as straight as the back. The animal should be evenly and symmetrically balanced at every point, with the result that it will be able to move freely and carry itself in a gay and majestic manner.

Romney Marsh.—The Romney Marsh breed was evolved under damp conditions in Kent and its strong constitution is well recognised.

Marked improvement in conformation and wool production was wrought by New Zealand breeders, who have produced a short-legged type that shows more refinement, symmetry and deeper fleshing than the original Romneys, but which still retains the constitution of the breed, making it particularly adaptable to cold, wet conditions.

Plate 18 shows a typical "modern" Romney and the official breed description is as follows:—

Wide head, level between the ears, which should be large and thick and covered with fine hair, or preferably partially covered with a soft, downy wool, a good thick foretop, and no horns or dark hair on the poll, which should be covered with wool. Eyes should be large, bright and

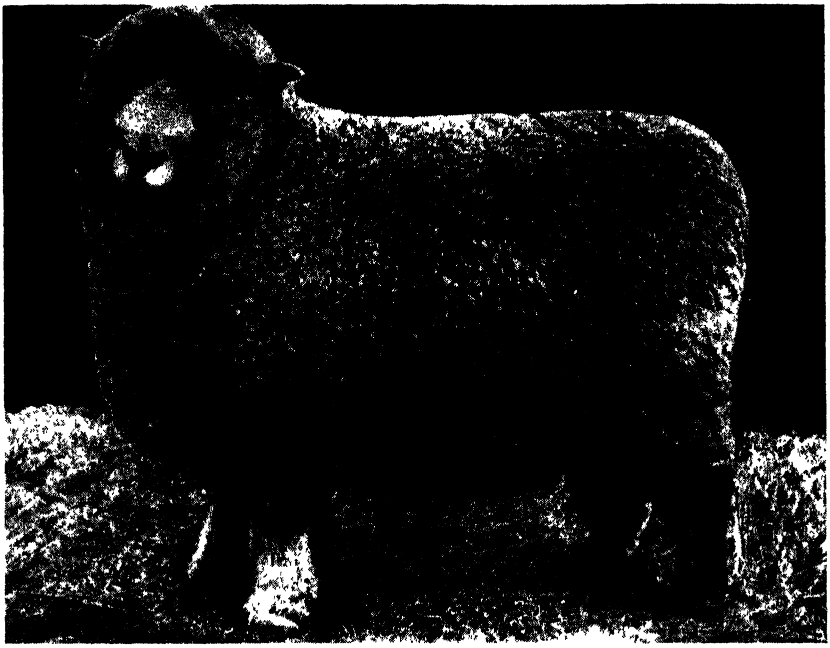


Plate 18.
A ROMNEY MARSH RAM.

prominent, the face in ewes full, not too white, and in rams broad and masculine in appearance. The nose in all cases must be coal black. The neck should be well set in at the shoulders and strong and thick, the shoulders wide, well put in and level with the back. (High-shouldered sheep are bad travellers, and a drop behind the shoulders, though to some extent characteristic of the breed, spoils many an otherwise good sheep). Chest wide and deep. Back straight, with wide and flat loin, ribs well sprung, loin of good length, and rump wide, long, and well turned. Tail set in almost level with the chine, a low-set tail being objectionable, as ewes with that defect often fail as breeders. Belly fairly let down and flank well developed. Thighs well let down and developed, a most important point. Legs should be set well apart, short, plump and ham-shaped, with big bone and large, shapely feet of black horn. Although black feet are preferable, there is usually a considerable proportion of light-coloured feet in every Romney flock, and a really good sheep should not be condemned on that account. It is often stated that Romneys with light-coloured feet suffer more from footrot than those with black, but such has not been the general experience.

The fleece should be of dense, even quality, and of a good, decided staple from the foretop on the head to the end of the tail. The wool should be even in length from the head to the tail, and free from kemp (a white hair which will not work up in material or absorb dye). Of course, the best part of the fleece is found on the fore-end of the sheep, but it should be the aim of every breeder to produce a covering as even as possible. A good covering of wool on the back is essential and when

grasped should fill the hand, not feel thin and weak. The fleece should be of good length, open freely, be crimpy from skin to tip, lustrous and soft, have a dense feel, and be free from cross fibres. The skin should be of a clean, pink colour, a sign of health and good constitution.

Corriedale.—The Corriedale is usually regarded as a utility breed—that is, it combines valuable mutton and wool characters. This breed was developed in New Zealand some 70 years ago and the most successful foundation cross seems to have been the Lincoln and the Merino. The progeny were inbred and heavy culling was practised. A distinct type has now been established and the breed has become popular in areas where agriculture and/or pasture improvement are practised. The type of sheep most desired has a large frame and is of good conformation. It is a heavy cutter and the wool is usually of a 50–56's quality and is of distinctive style and character.

Plate 19 depicts a good quality Corriedale ram, and the following description may be taken as giving a general idea of the points of the breed:—

General Appearance.—The Corriedale should at once give the impression of being a well-woolled and evenly-balanced sheep of remarkably hardy constitution, the ram of distinctive character and bold outlook. Being a dual-purpose sheep, consideration should be given to both wool and carcase.

Head.—Hornless, broad, strong, well-woolled, but free from wool blindness. Black or blue spots on the ears are no defect, but black or brown spots on hair or wool are faults. Wide-open nostrils, black for preference.

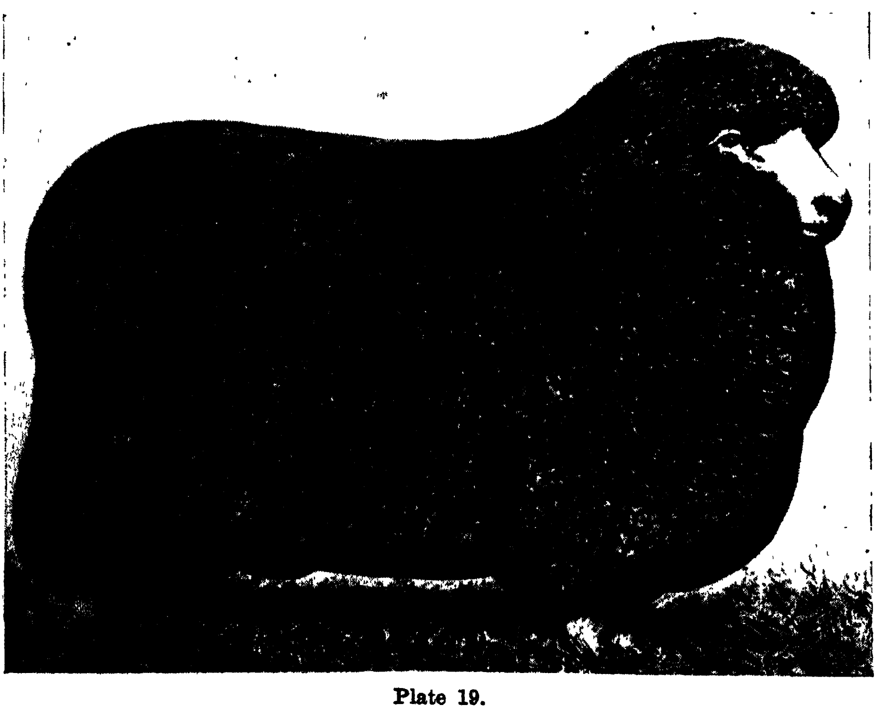


Plate 19.

A CORRIEDALE RAM.

Neck.—Broad and strong, forming a good scrag. *Back.*—From neck to rump long, level, and broad. *Brisket.*—Deep and wide. *Ribs.*—Well sprung and deep. *Hindquarters.*—Well apart, deep and broad, and well let down towards the hocks. *Legs.*—Moderate length, with good bone, set straight and well apart. The hoof should be of fair size, well formed, and preferably black in colour.

Wool.—The Corriedale should carry a heavy, even fleece of good length, dense staple, pronounced crimp, and a level tip. The quality aimed at is a long-stapled, dense, bulky 50's-56's, but a somewhat lower spinning grade, especially in a ram, is not to be discriminated against. A characteristic of the pure Corriedale sheep is the remarkable evenness in the length, density, and quality of the fleece throughout. In the males the purse should be covered with wool, not too coarse or hairy in texture.

When buying Corriedales the purchaser should see that the jaws are neither undershot nor overshot. Sheep with horns (other than button-horns not firmly attached to the skull, which are permissible but not desirable) should be discarded. When the buyer has satisfied himself as to the wool he should look to the conformation and carefully handle the sheep, commencing at the neck. See that the "scrag" is broad and strong, that the shoulder blades are wide apart, and that there is no "devil's grip." The ribs immediately behind the shoulder should be well sprung and in conformity with those further back. There must be no dip behind the shoulders or hollow in the back, and the loin and the hook bones must be wide, with but little droop thence to the tail-head. Arms and thighs should be wide and deep and come well down towards the knees and hocks.

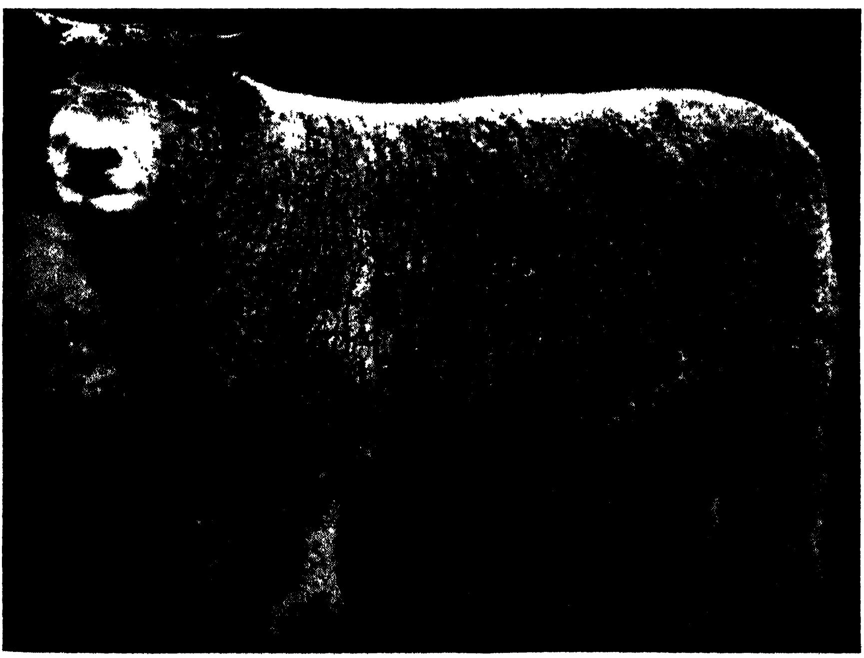


Plate 20.

A SOUTHDOWN RAM.

Short-woolled Breeds.

Southdown.—The Southdown is regarded as one of the oldest pure-bred sheep in Britain. It is the smallest of the Downs breeds and makes an excellent sire of export lambs. It is usually considered that the Southdown should be used in areas where conditions are good. This is because it is an early maturing breed—that is to say, young animals of this breed or sheep carrying an infusion of Southdown blood have the proportions of bone, muscle, and fat which are found only in mature animals of most other breeds. It is clear from Plate 20, which shows a typical Southdown, that the breed to-day is built more or less on the lines of a box, the "box" being set squarely on legs at each corner. The feet are not as large as those of the Romney but should be reasonably big—a narrow, pointed foot being undesirable. The pastern should be strong, and set so that the sheep can move. A straight pastern is not wanted. The bone above the pastern need not be big but should slope back like the shoulders of a good horse, while the shoulder should be flat and wide on top, the back strong and wide, and the loin flat. The ribs should turn well out and the rump should be flat and square to the tail. The sheep should not slope down at the rear end but should go straight down, with plenty of bulk in the hind legs.

Constitution and adequate heart room are most essential. The neck should be set in exactly with the shoulder and must be broad, strong, and short. The poll should be flat, the head wide and flat between the eyes, and the face not too long with broad, open, wide nostrils. The underjaw must be deep and strong, coming up squarely with the teeth neither overshot nor undershot, either of these defects being a culling point.

The approved colour of the face is a soft, mousy tint. The colour may be darker or lighter but should be even on head and feet. The poll should carry no horns; the ears should not be too large and should have a nice "handle." The flesh should be soft but firm, while the wool, though a secondary consideration from the utility point of view, must be dense, fine, and even all over. The sheen of the skin when the wool is opened is very important. On any young sheep it should be "baby" pink in colour. Southdown mutton is of excellent quality but it can easily be fed too fat.

As a pure breed the Southdown may be a little difficult to manage, as the sheep can become cast quite easily.

Dorset Horn.—The Dorset Horn has a special role in the lamb industry in Queensland for the siring of very early crossbred lambs. The young sheep grow very quickly. Quick growth rate is not to be confused with early maturity. Although the Dorset Horn and Dorset Horn crosses grow very rapidly the bone, muscle, and fat composing the carcase of these sheep do not necessarily reach the proportions of maturity at an early age. However, the modern Australian Dorset Horns, which are probably as good as any in the world, have a marked tendency towards early maturity. It is stated that the rams will work more actively and earlier than those of other breeds, but the breed's weaknesses are in its longish carcase, high, open shoulders, and a tendency towards deficiency of rib and hindquarter. In Queensland the capacity of the Dorset to grow rapidly and its adaptability make it an extremely useful breed.

Dorset Horn Merino crossbreds are particularly good fat lamb mothers, but they do not produce a very valuable fleece, and this is an unfortunate, but important, deficiency.

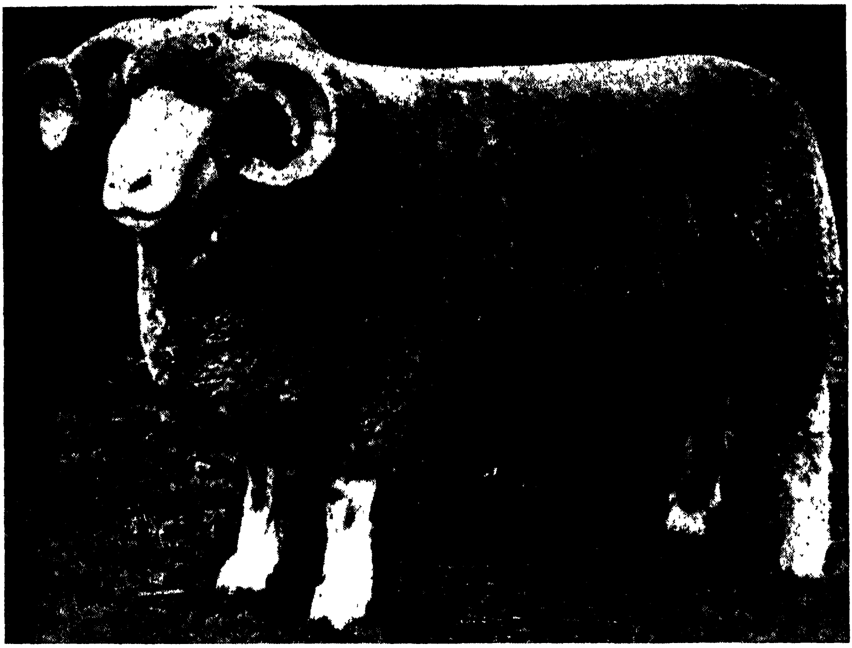


Plate 21.
A DORSET HORN RAM.

The Dorset ram shown in Plate 21 is bold and masculine in appearance, horns strong and long, growing from the head well apart on the crown in a straight line with each other, and coming downward and forward in graceful curves as close to the face as may be without necessitating cutting. In the ewes the horns should be much smaller and more delicate. The general characteristics are—head broad, full and open at the nostril, well covered with wool from brow to poll, face white, with pink nose and lips; ears of medium size and thin; neck short and round, well sprung from the shoulder, with no depression at the collar, and strong and muscular, especially in the ram.

Crossbreeding for Lamb Production.

The two most important factors in fat lamb production are correct breeding and correct feeding.

The following are the characteristics which are important in ewes selected as fat lamb mothers—

(i) Suitable conformation; that is the ewes should be big, square framed and roomy with well formed udders and a tendency towards depth of fleshing.

(ii) Prolificacy; that is, they should produce a large number of lambs during their breeding life. This means that they should have twins in at least some years.

(iii) A long breeding season and capacity to mate early.

(iv) Good maternal and milking qualities.

(v) A temperament suited to an agricultural environment.

(vi) Production of a fairly valuable fleece.

It is necessary to use Merino ewes in any programme of lamb production in this State and the way in which this might be done depends upon the trade for which the lambs are being produced. For the export trade, in which overseas competition must be met, it is preferable to cross Merino ewes with long woolled rams and use the female offspring as fat lamb mothers. The male offsprings make quite good lambs for the local trade. The most popular first-cross ewes are Border Leicesters x Merino and Romney Marsh x Merino. The latter are more popular in the heavier rainfall areas.

The Corriedale x Merino cross makes quite a good lamb mother. These sheep are usually considered to have a slightly longer breeding season than the Romney Marsh or Border Leicester cross. They also cut a heavier and more valuable fleece, but the lambs are not quite as good in conformation. These ewes are preferred by some breeders in riskier districts as they produce quite good "carry-over" lambs. Pure Corriedale ewes make good lamb mothers but are rather expensive for such a purpose.

The selection of the breed of rams used to mate with crossbred ewes to sire fat lambs is important because particular breeds make a definite contribution towards the conformation, growth rate and suitability of the lambs for their environment. The Downs breeds combine most of the desirable characters and of these the Dorset Horn and Southdown are particularly suited to Queensland conditions. It is usually considered that the latter breed excels for the production of high-grade lightweight export lambs. Some lamb growers contend, however, that Southdown lambs demand ideal conditions, otherwise they are inclined

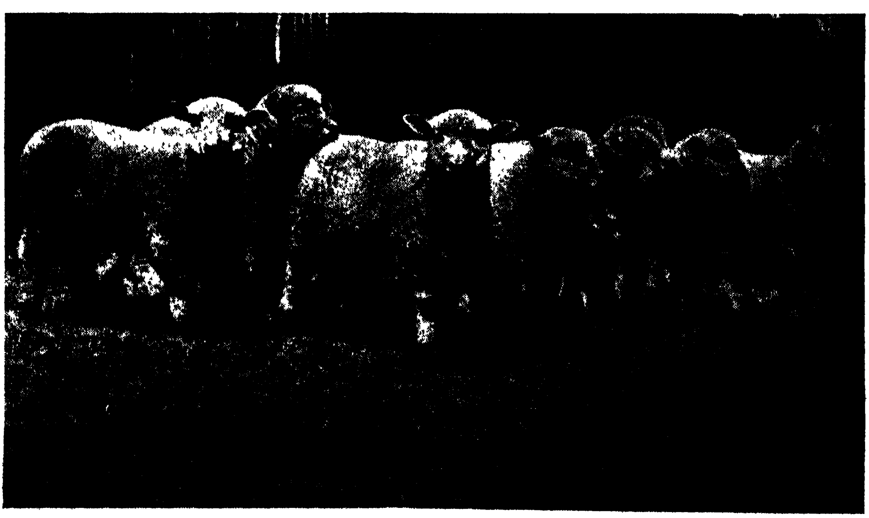


Plate 22.

A GROUP OF EXCELLENT QUALITY EXPORT LAMBS SIRED BY SOUTHDOWN RAMS.

to have the proportions of maturity before they reach a suitable weight for slaughter. If the lambs are held to allow them to reach this weight they lay down an excessive amount of fat and most of this is deposited on the lower part of the ribs. Such a carcase is not suitable for a high class lamb trade.

Lambs sired by Dorset Horn rams grow very quickly and this is an advantage under Queensland conditions where crops are utilised for lamb fattening. They are also readily adaptable to the agricultural environment and the rams are not likely to be cast as are the Southdowns.

For the local trade the crosses described above will give the best quality lamb, but for a number of reasons producers may not be able to follow such breeding practices.

When wool prices are high the value of the fleece cut by Merino ewes is sufficient to ensure their popularity on most farms. In addition, they have a particular attribute in the marginal lamb country in that their wool clip is generally good even if the season is so unfavourable that it is not possible to grow crops to produce lambs. On the other hand, when wool prices are low Merino ewes are the cheapest "breeding unit" to buy and Merino wool usually brings more than crossbred wool does on the open market.

Accordingly, a large number of lambs produced in Queensland are from Merino ewes and are sired by rams of one or other of the English breeds or Corriedales. If the lamb-raiser wishes to use Merino ewes as mothers and sell all the offspring as fat lambs he would be well advised to use Dorset Horn rams as sires. On the other hand, if he wishes to rear some of the female offspring for sale as fat lamb mothers or as replacements in his own breeding flock it would be preferable to mate the Merino ewes with Corriedale, Border Leicester or Romney Marsh rams.

However, the practice of retaining a portion of the female drop as future replacements in the flock to serve as lamb mothers cannot be generally recommended. Very often it is the slowest growing "tail enders" which do not reach a marketable weight within a reasonable time that are retained in the flock. This means that the farmer is selecting for *slow* growth rate rather than for the *rapid* growth rate which is so desirable. Such a practice cannot be condemned too roundly.

As the land in the lamb-growing areas is valuable it is uneconomic to grow crossbred ewes in these districts. Accordingly there is a good opportunity for some sheep-raisers in Queensland to establish themselves as producers of crossbred ewes. These sheep are in fairly steady demand and accordingly the market does not fluctuate to the same extent as does that for Merinos.

PRINCIPLES OF LAMB PRODUCTION.

The Growth and Development of Lambs.

The rapidity of growth and the type of development of the lamb both prior to and subsequent to birth are important as they influence, in a very material way, the commercial return the farmer will obtain from his annual turn off of lambs.

The relationship between liveweight and age is shown in Plate 23. It is seen that the lamb develops slowly at first but shortly before birth is making more rapid growth. Growth reaches its maximum rate soon

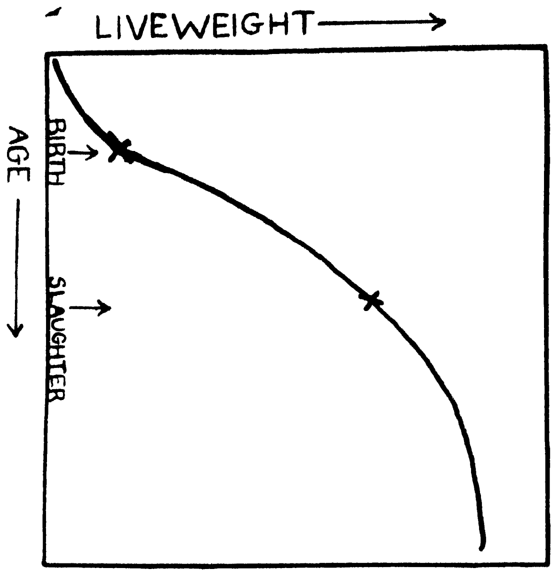


Plate 23.
RELATIONSHIP OF LIVEWEIGHT TO AGE.

after birth, but it decreases as maturity is approached. The basic principle of lamb production is to utilise that period of most rapid growth rate to maximum advantage, and slaughter should take place before or just at the point where the diminution in growth rate commences.

During the time the lamb is developing within its mother its head and forelimbs make more rapid growth. It is usually considered that there is a "growth centre" in the head and this ensures the initial development of this part of the animal. What might be likened to "waves of growth" spread downwards from the head. Other "growth centres" are located in the limbs and these ensure rapid development of these organs so that when the lamb is born it is virtually all head and legs. The growth waves spreading up from the limbs and those coming down from the head finally meet in the loin of the animal and this part is thus the last to develop. Heavy development of the hindquarters and the more valuable cuts of meat they contain has become a characteristic of some breeds of sheep as the result of domestication and selective breeding, but even now adequate feeding is necessary to develop these desirable features. It also ensures heavy birth weight and rapid growth rate of the lambs, which are desirable characters.

Factors Affecting Birth Weight.

Every sheep farmer knows that size, weight and shape of lambs vary considerably at birth. There are variations between breeds and within breeds. The observant sheep man will probably be able to suggest a connection between the size and age of the ewe and the size of her lamb. The number of lambs born to one ewe—that is, either twins or singles—and the way in which the ewe was fed during pregnancy also have an important influence on the birth weight of lambs.

Some interesting figures, which demonstrate the differences in the birth weight of lambs from different breeds, have been obtained in New Zealand. They are as follows:—

Merino (singles)	7·7 lb.
Southdown	8·6 „
Corriedale	10·1 „
Romney Marsh	11·9 „

In a series of experiments conducted in Western Australia, lambs from Merino ewes sired by Dorset Horn, Shropshire and Southdown rams averaged 8·8 lb. at birth. The lambs from Border Leicester x Merino ewes and sired by the same rams averaged 10·4 lb. at birth. It is important to realise the significance of these figures and select crossbred ewes as fat lamb mothers.

Investigating the factors which influenced the birth weight of lambs in Western Australia, Border Leicester x Merino ewes were mated with Southdown rams and observations were made on the influence of sex, number born and level of prenatal feeding on birth weight and growth rate of the lambs under identical conditions. The results are set out in the following table:—

—	Birth Weight		Time taken to reach Slaughter Weight. (65 lb. Liveweight.)	
	Males.	Females.	Males	Females.
Singles—	Lb.	Lb.	Days.	Days.
Mothers very poorly fed ..	9·5	8·9	89	100
Mothers well fed	10·9	10·2	86	94
Twins—				
Mothers very poorly fed ..	7·7	6·5	111	123
Mothers well fed	9·8	9·2	99	107

Under average conditions, differences in the birth weight of single lambs of ewes well and poorly fed are not so obvious. The differences of the plane of nutrition in the experiment were extreme. However, the effect of feeding of the ewe on the birth weight of twins is commonly noted in the field.

The Growth of Lambs after Birth.

The birth weight of the lambs, the breed of the sheep and the milking capacity of the mother are all important factors influencing the growth rate of lambs.

The milking capacity of ewes has been studied on a number of occasions and here again differences due to breed and to the way the ewes are fed have been noted. Crossbred ewes not only milk longer and more heavily than do Merinos but they also show a definite peak, reaching maximum production in about three weeks after lambing.

The lactation curve of average ewes is shown in Plate 24

Growth is really a period of protein storage and accordingly the protein requirements of rapidly growing animals is high, but it falls considerably as maturity is reached. This is depicted graphically in Plate 25.

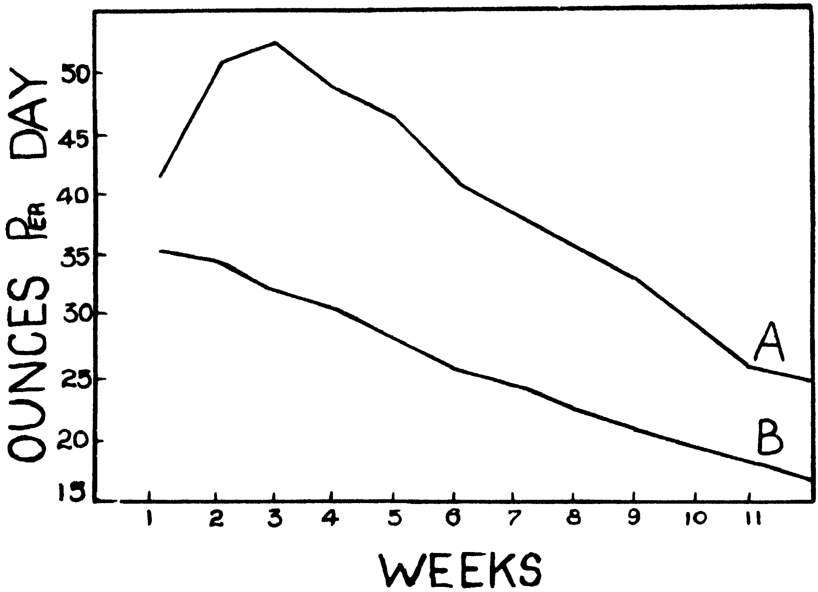


Plate 24.

LACTATION CURVES OF A, CROSSBRED EWES; B, MERINO EWES.

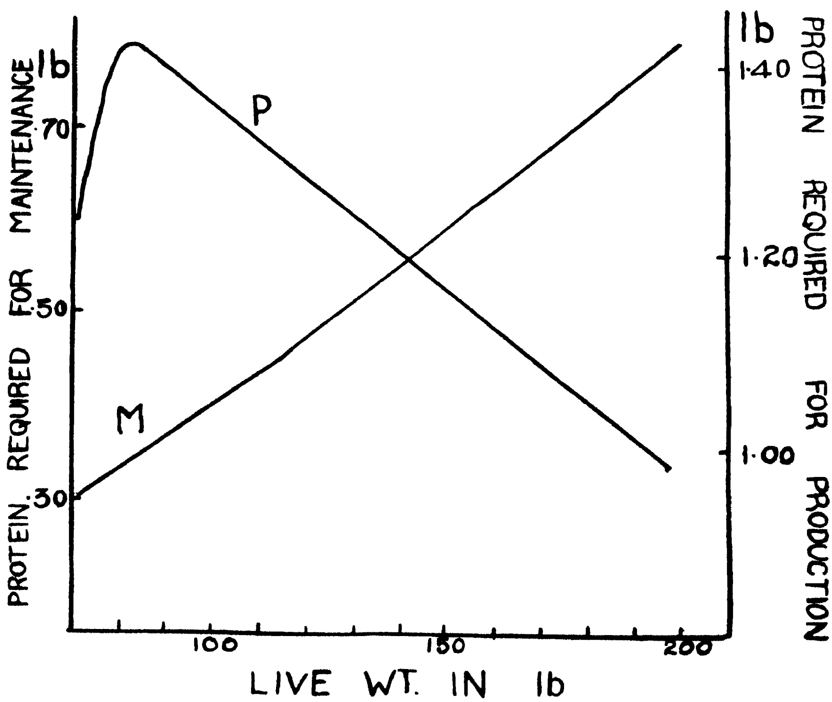


Plate 25.

PROTEIN REQUIREMENTS OF SHEEP FOR MAINTENANCE (M) AND PRODUCTION (P) IN LB. PER WEEK.

The relationship between liveweight and cumulative feed consumption is well known to all sheep men who have observed the growth made by lambs in relation to the way a crop has been grazed. The relationship could be depicted in the way shown in Plate 26.

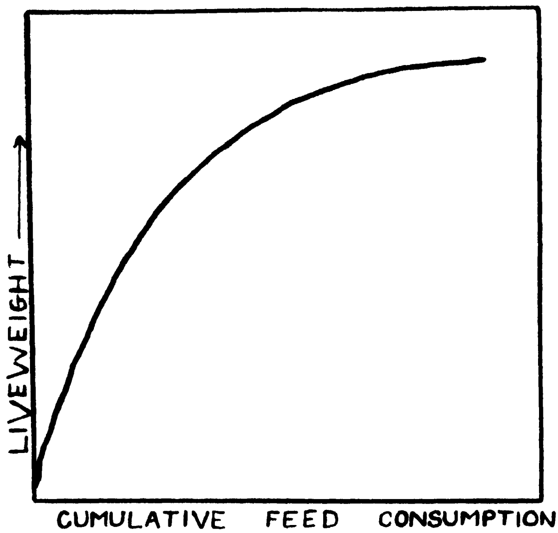


Plate 26.

RELATIONSHIP BETWEEN LIVEWEIGHT AND CUMULATIVE FEED CONSUMPTION.

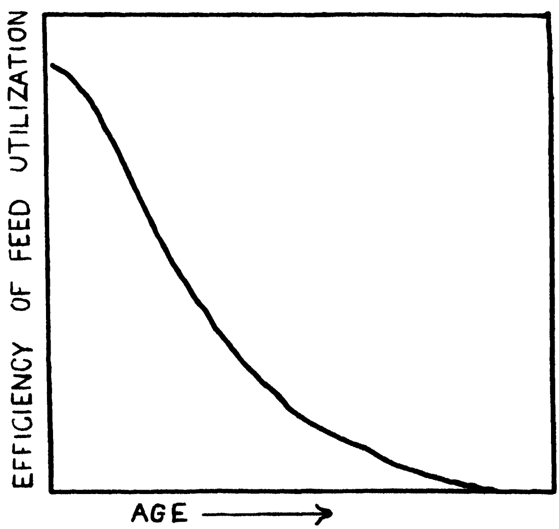


Plate 27.

EFFICIENCY OF FEED UTILIZATION, OR $\frac{\text{WEIGHT GAIN}}{\text{FEED.}}$, RELATED TO AGE.

There is a decrease in rate of liveweight gain as the cumulative feed consumption increases. In other words, the efficiency with which the lamb converts its food to flesh decreases as it grows older. This occurs in the way depicted in Plate 27.

The efficiency with which food is utilised for the production of meat is also an important breed characteristic. Differences between breeds such as the Merino and the Southdown or the Dorset Horn would be shown by the variation in the shape of the efficiency curve in Plate 27. It is usually considered that the graph for the efficiency of conversion by Merinos drops earlier and more steeply than for Southdowns and Dorsets.

Influence of the Plane of Nutrition on Growth and Carcase Quality.

The relative proportions of different parts of the body change with age while the animal is growing. While breed influences the rate and type of change, the plane of nutrition which the lambs enjoy from birth until they are sold is of greatest importance. The aim in lamb production is to ensure that the young animal, with its high proportion of stewing chops, neck, shins, and shank, quickly develops the deep fleshing of the valuable hindquarters.

In studying the effect of the plane of nutrition on the growth and development of lambs, several research workers have experimented with different rations and the results which have been obtained are depicted in Plate 28.

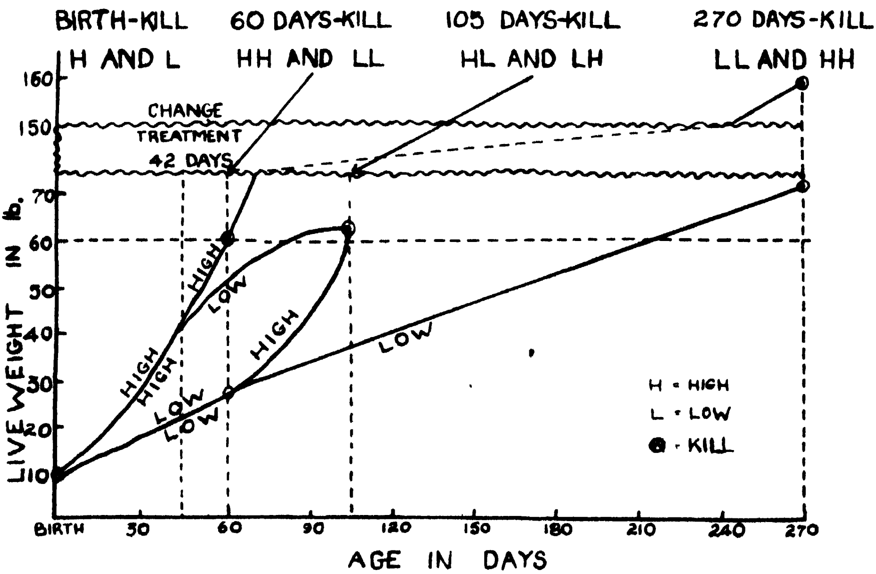


Plate 28.

THE EFFECT OF PLANE OF NUTRITION ON BODY WEIGHTS OF FAT LAMBS.

The different growth curves were plotted prior to the commencement of the experiment and feed was regulated to make the liveweights follow the curves.

Ewes were divided into two groups, one on a high plane of nutrition and the other on a low plane. Feeding the mother for the last two months of pregnancy makes possible an increase in the birth weight of the lamb and so alters the composition of the tissue.

The high-plane ewes gained 39½ lb. in weight before lambing, whereas those on the low plane had only increased by 1 lb. After lambing, milk yields were much greater for the high-plane ewes; also, they were "in milk" for about four months as compared with two months for the low-plane ewes.

After 42 days both high and low lamb groups were subdivided; half the high group continued on a high plane (high-high), while the other half were reduced to a low plane (high-low). Similarly, with the low group half continued on the low plane (low-low) and the other half were increased to a high-plane ration (low-high).

Lambs from each group were killed periodically to examine the proportion of bone to muscle and fat.

Those killed from the high-high group showed a small proportion of bone with a higher proportion of muscle and fat.

The high-low lambs showed larger bones and more muscle and lacked finish.

The low-high kill showed small bones and moderate to good muscle; though lacking in fat, they were fatter than the high-low group.

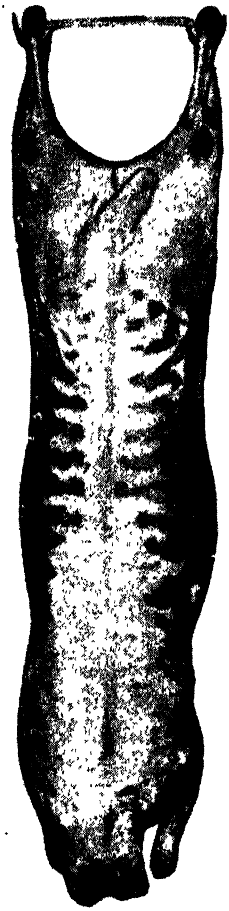
It is known that muscle, fat, and bone grow at different rates and at different times, and the first to reach the period of most active growth is bone, then muscle, and then fat. When conditions are imposed (for example, a low plane of nutrition) which will reduce the speed of increase in the liveweight, the process of converting food to fat will be the first to stop, then muscle development, and finally bone.

Therefore, the successful production of good quality lamb, which shows the proportionate light bone to muscle and fat, demands continuous good feeding from before birth to the time of marketing.

From the commercial point of view it is essential to get the lambs off the property as quickly as possible and accordingly the importance of maintaining them on a uniformly high plane of nutrition is obvious. It was noted, however, that there was considerable difference in the relative proportions of fat, muscle, and bone in the carcases produced by the lambs subjected to the different methods of feeding. This is clearly seen by comparing the carcases shown in Plates 29, 30, and 31. Those from the other sheep which were grown on the high-high plane of nutrition showed a correct balance of muscle, fat, and bone (Plate 29). Those grown on the high-low plane of nutrition were lacking in fat but the skeletal and muscular systems were quite well developed (Plates 30 and 31). Of these, the carcase shown in Plate 30 was from a lamb which was badly bred and badly fed, and that in Plate 31 was from a lamb well bred but badly fed. Those grown on the low-high plane of nutrition lacked muscle development and the fat was laid down unevenly. Those grown on the low-low plane of nutrition had long, poorly covered bones.

From the point of view of conformation and quality, then, a uniformly high plane of nutrition is necessary.

A point worth remembering is that sheep which are well fed—that is, are on a high plane of nutrition—are more likely to be affected adversely by hot weather. This is important when summer crops are being utilised for lamb production. However, they are less likely to be affected adversely by worm infestation.



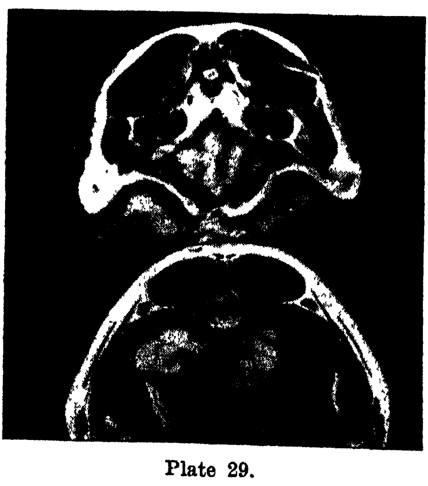


Plate 29.

A WELL-BRED LAMB WHICH WAS WELL FED THROUGHOUT, ENSURING AMPLE DEVELOPMENT OF THE HINDQUARTER AND LOIN AND AN IDEAL BLEND OF MUSCLE AND FAT.

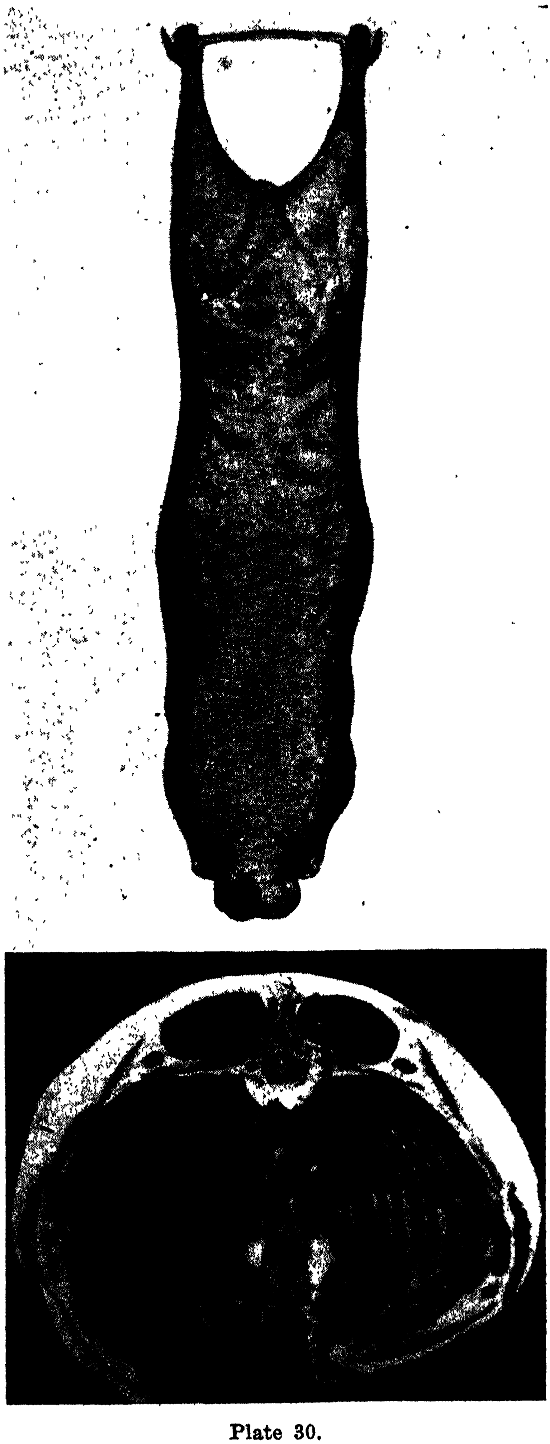


Plate 30.

THE CARCASE OF A BADLY BRED SHEEP WHICH WAS "TOPPED-OFF."—Note the excessive fat over the small "eye" muscle of the chops.

Plate 31.

WELL BRED BUT BADLY FED.—This lamb was inadequately fed when young and finished off too quickly.

Feeding Dairy Cows for Profit and Production.

R. D. CHESTER, Officer in Charge, Cattle Husbandry Branch.

THE rational approach to the feeding of cows for milk production is to attempt to supply a ration balanced in energy, protein and mineral content for the volume of milk production.

A farmer's ability as an efficient feeder is measured by his capacity to adjust the cost of feeds and the value of milk produced so that the difference between costs and returns will be as great as possible. This means striking a balance between not feeding supplements at all, on the one hand, and feeding cows to the absolute maximum of their production capacity on the other. Generally, it will be necessary to feed a variety of feeds, most of which are home-grown, to cows selected for their production ability so that each cow produces a fairly high yield of milk.

To feed efficiently the farmer must produce a large amount of milk from each of his cows. The high-producing cow is more efficient in converting food to milk than is the low producer.

When planning a programme of heavy supplementary feeding, the farmer should also embark on a programme of breeding for high production and be prepared to cull out low producers from the herd. Each cow's capacity to produce milk is limited by certain inherited factors. Feeding for production above the inherited maximum will not result in increased output of milk and the extra feed will therefore be wasted.

THE IMPORTANCE OF HOME-GROWN ROUGHAGE.

Under Queensland conditions, production of milk or other dairy produce depends largely on the roughage feeds and profits will be large or small according to the ability of the farmer to produce suitable home-grown roughages cheaply and to supplement them with concentrates which are reasonably cheap.

Good results from feeding will most often be obtained when the value of large amounts of good quality roughages is realized. Generally, cows should have available as much good quality roughage as they can

eat. It is not sound thinking to hope that cows getting insufficient roughage to fill the gut can be induced to produce profitably by the addition of a few pounds of concentrate to the ration. However, high-producers are incapable of eating sufficient roughage for maximum production and some supplementary feeding with concentrates is necessary if the most profitable level of production is the aim of the farmer.

All dairy cows therefore should be fed all the hay and/or silage, plus grazing, that they can eat.

The best grazing is young green crops or fresh green pastures. As crops and pastures mature, their feeding value decreases and it becomes increasingly important to feed more concentrates.

Good quality legume hay is the best type of hay to use. It contains the same energy equivalent as good cereal or grass hay, but is richer in minerals and in protein, this latter quality being of particular importance in a State such as Queensland where frequently protein intake limits production. However, cereal hays are quite suitable for dairy cows provided they are supplemented by the right type of concentrate.

Silage is an excellent roughage feed, but it should not be used as the only source of roughage. However, if fed at the rate of about 3 lb. per day for each 100 lb. bodyweight it forms a very good supplement for feeding with pasture or hay. Silage may taint milk if fed immediately before milking. If this occurs, an alteration in the feeding routine should be made to ensure that all silage is fed at least two hours before the cows are milked.

CHOOSING CONCENTRATES TO SUPPLEMENT ROUGHAGE.

The roughage supplied will usually be that most easily and most economically grown on the farm. Having supplied cows with adequate roughage, the farmer must then turn his attention to the concentrate supplement to be fed in order to maintain a good milk yield. It is necessary to decide just what ingredients will be incorporated in the concentrate mixture. Having done this, it is then time to assess the rate at which to feed the mixture. These decisions will be guided by—

(*a*) Kind and quality of roughage fed,

(*b*) Milk production of each cow.

(*c*) Costs of various concentrate feeds.

(*d*) Price obtained for dairy produce.

The protein content of the concentrate will be determined by the type of roughage fed. Having decided the protein requirements, the farmer then must seek the cheapest combination of ingredients which will give a final concentrate mixture of the required protein content.

The character of the cow and her feed capacity should be studied. Some cows have the ability to eat larger quantities of feed than others and so will make use of more home-grown roughage and require less purchased concentrate. Avoid feeding too much grain and avoid especially sudden changes from roughage to grain feeding, as such methods will cause serious 'feed sickness' and a corresponding reduction in yield.

In order to feed with some degree of accuracy, it is necessary firstly to know within fairly accurate limits just what is the production of individual cows. It is then necessary to feed cows individually or in groups of cows of about the same production.

It is wasteful to feed a whole herd on the same basis. By this method, the higher producer gets too little feed and as a result her production is reduced, and the low producer gets too much food for which there is no compensating lift in production.

It is convenient to keep a chart in the dairy with each cow's name, her approximate daily production and the amount of concentrate to be fed.

Thus—

Name.	Production. Lb. of Milk.	Concentrate. Lb. per Day.
Belle	15	2
Beatrice	20	4
Buttercup	25	6

Provided roughage can be produced on the farm, it will be a cheap form of feed, and in these circumstances should be fed to the maximum possible limit. On the other hand, in dairies where roughage is purchased on the open market, it will frequently be more expensive per food unit than are concentrate foods. In such cases a different approach to rationing is necessary and the amount of roughages must be decreased and concentrates increased according to prices.

Where roughage is cheap, therefore, cows should be given constant access to this class of food.

TABLE 1.

Type of Roughage	Percentage of Protein necessary in Concentrate.	Typical Concentrate Mixture
Lucerne Hay	10–12	Grain alone, or grain plus mill offals
Other Legume Hay of Choice Quality	10–12	..
Young Green Cereals, Choice Pasture	10–12	..
Mixture of Legume and Cereal Hay	14–16	Grain .. .. 3 parts
Legume Hay and Sorghum Silage	14–16	Pollard .. .. 1 part
More Mature Green Crops (Cereal or Sudan Grass or Millet)	14–16	Bran .. 1 part
Good Quality Pasture	14–16	Linseed Meal .. 1 part
Cereal Hay	18–20	Grain .. .. 3 parts
Fair Quality Pasture	18–20	Bran .. .. 2 parts
Mature Green Crops	18–20	Linseed Meal .. 4 parts
Mature Pasture	24	Grain .. .. 3 parts
Cow Cane	24	Bran .. .. 2 parts
Sorghum Silage	24	Meatmeal .. 2 parts

Where roughage contains no legume, it is wise to add 2 per cent. ground limestone to concentrate mixture.

Table 1 sets out the protein percentage required in the concentrate mixture for feeding with various forms of roughage. This table is an adaptation of a table by T. E. Woodward in the United States Department of Agriculture Year Book for 1939.

Because the protein content of the roughages will vary somewhat according to their stage of development at harvesting and according to the efficiency with which the original crops are conserved, the table should be interpreted liberally and adjustments made according to the quality as well as the type of roughage.

Suggested Concentrate Mixtures.

The following meals are given as suitable concentrate mixtures of the correct protein content for the various roughages as set out in Table 1.

Mixtures containing 14 to 16 per cent. protein.

(1)	Crushed oats	4 parts
	Cracked corn	4 parts
	Meatmeal	1 part
(2)	Crushed oats	1 part
	Crushed sorghum	2 parts
	Linseed meal	1 part
(3)	Crushed sorghum	3 parts
	Crushed corn	3 parts
	Cottonseed meal	1 part
(4)	Crushed oats	3 parts
	Crushed corn	3 parts
	Crushed sorghum	3 parts
	Peanut meal	1 part

Mixtures containing 18 to 20 per cent. protein.

(1)	Crushed corn	2 parts
	Crushed sorghum	1 part
	Bran	1 part
	Pollard	1 part
	Peanut meal	1 part
(2)	Crushed sorghum	3 parts
	Crushed oats	2 parts
	Crushed corn	2 parts
	Meatmeal	2 parts
(3)	Crushed oats	1 part
	Crushed corn	2 parts
	Linseed meal	2 parts
(4)	Crushed sorghum	5 parts
	Crushed maize	6 parts
	Linseed meal	2 parts
	Peanut meal	2 parts

Mixtures containing 24 *per cent. protein.*

(1)	Crushed corn	2 parts
	Crushed oats	1 part
	Bran	2 parts
	Peanut meal	2 parts
	Linseed meal	2 parts
(2)	Crushed corn	9 parts
	Crushed oats	4 parts
	Meatmeal	7 parts
(3)	Crushed corn	6 parts
	Crushed sorghum	6 parts
	Crushed oats	3 parts
	Bran	5 parts
	Pollard	5 parts
	Peanut meal	6 parts
	Meatmeal	6 parts
(4)	Crushed corn	4 parts
	Crushed sorghum	4 parts
	Cottonseed meal	8 parts

Estimating Amount of Concentrate to Feed.

In feeding the concentrate, it is convenient to estimate the amount to be fed on a per-gallon-of-milk-produced basis. That is, if concentrate is to be fed at 2 lb. per gallon, the cow producing three gallons of milk will receive 6 lb. of concentrate, and so on.

TABLE 2.

A GUIDE TO FEEDING CONCENTRATE MIXTURE.

Breed of Cattle	Where Cows are Fed all the Roughage They will Eat.	Where Roughage Feeding is Limited.
Friesian	1 lb. concentrate mixture to 4·5 lb. milk	1 lb. concentrate mixture to 4 lb. milk
A.I.S. and Ayrshire	1 lb. concentrate mixture to 4 lb. milk	1 lb. concentrate mixture to 3·5 lb. milk
Jersey and Guernsey	1 lb. concentrate mixture to 3·5 lb. milk	1 lb. concentrate mixture to 3 lb. milk

However, some adjustment should be made for the butter-fat content of the milk. It is sufficiently accurate to estimate according to the average test of the breed. Table 2 sets out the rate at which to feed concentrates to each breed if the farmer aims at feeding for full production.

It should, however, be borne in mind that frequently it will not be profitable to feed at this level under Queensland conditions, and in that case the farmer must be prepared to settle for something less than full production from his cows.

The Selection of Concentrate and Grain to Feed.

By consulting Table 3, which sets out the average food unit value and digestible crude protein content of the commonly available concentrates, the farmer should be able to substitute one concentrate for another in any of the mixtures given, if the constituents for the original meal are not readily available.

TABLE 3.

FODDER VALUES OF COMMONLY USED CONCENTRATES.

—	Average Food Units per 100 lb (Starch Equivalent).	Digestible Crude Protein per 100 lb.
	Protein-rich Concentrates.	
Blood Meal	63	68
Meatmeal	77	54
Peanut Meal	78	43
Cottonseed Meal .. .	67	33
Linseed Meal .. .	72	25
	Carbohydrate-rich Concentrates.	
Maize Grain ..	77	8
Wheat Grain	72	8
Oat Grain . .	61	8
Sorghum Grain . .	76	7
Bran	56	10
Pollard . . .	66	10
Molasses	50	Nil

In any case, these mixtures should only be taken as guides and alterations must be made according to the price of the various ingredients if the most profitable level of feeding is sought.

Generally, price per food unit and price per pound of protein will determine the particular concentrate to be used, though factors of palatability and texture must be considered.

It is, where possible, preferable to feed a mixture of grains rather than one particular grain, but this general rule may be ignored if one type of grain is very much cheaper than others For instance, if a farmer can produce grain sorghum on the farm at a low price it would be unwise for him to purchase other grains on the open market to mix with his grain sorghum just for the sake of feeding a better balanced grain mixture.

In selecting grains, therefore, the choice should be made according to cost per food unit.

In selecting protein-rich concentrates, the choice will be determined by the cost per pound of protein rather than the cost per food unit, as generally these concentrates are fed in order to build up the protein percentage of the ration, though of course, at the same time, they do replace part of the energy-rich concentrate in the ration.

Estimating Cost of Grain.

The following is suggested by H. J. Geddes of the Sydney University as a convenient method of estimating the cost per food unit of each grain from the price per bushel.

The Cost per Food Unit is equivalent to

$$\frac{\text{Cost per bushel}}{\text{Weight per bushel}} \times \frac{100}{\text{Starch Equivalent of Grain}}$$

The factors "weight per bushel" and "starch equivalent" of any particular grain are constant. Therefore, the factor

$$\frac{100}{\text{Weight per bushel} \times \text{Starch Equivalent of Grain}}$$

is constant for a particular grain and may be expressed as a constant figure, namely:—

Sorghum .. .. .. 1/46 (that is $\frac{100}{60 \times 76}$)

Wheat .. .. .. 1/43 („ „ $\frac{100}{60 \times 72}$)

Maize .. .. .. 1/43 („ „ $\frac{100}{56 \times 77}$)

Barley .. .. .. 1/36 („ „ $\frac{100}{50 \times 71}$)

Oats .. .. .. 1/24 („ „ $\frac{100}{40 \times 61}$)

Thus for sorghum—

$$\text{Cost per Food Unit} = \frac{\text{Cost per bushel}}{46}$$

The following is an illustration of the use of this method using hypothetical bushel prices.

Grain.	Cost per Bushel.	Constant Factor.	Cost per Food Unit.
	s. d.		d.
Sorghum	5 9	46	1·5
Wheat	7 2	43	2·0
Maize	9 0	43	2·5
Barley	4 6	36	1·75
Oats	6 0	24	3·0

Thus, at the prices per bushel given, the farmer would feed as much sorghum as possible and avoid the use of maize and oats.

Most protein-rich concentrates are sold on a per ton basis. In order to work out the cost per pound of protein, it is necessary to know the protein percentage and to estimate the price per 100 pounds from the price per ton. Then divide the cost per 100 pounds by the protein percentage. Thus peanut meal with a protein content of 45 per cent. at 15s. per 100 lb. costs fourpence per pound protein.

Mineral Requirements.

Some consideration should be given to the mineral content of the concentrate ration. The chief minerals which require attention are lime, phosphate and salt.

For milking cows, it is desirable to add 1 per cent. of salt to all mixtures in order to avoid the risk of deficiency.

Most concentrate mixtures, especially those containing a high proportion of grain, are low in lime and relatively rich in phosphates and in cases where the lime content of the roughage is not likely to be high 2 per cent. of ground limestone should be added to the mixture. However, where large amounts of legume roughage are fed, adequate lime will be available from that source and there will be no need for addition of limestone to the concentrate portion of the ration.

In many parts of Queensland, pastures are deficient in phosphate and in most cases farmers cannot afford to feed concentrates except in limited quantities; in such cases, bonemeal should be added to the concentrate mixture to ensure that cows take from one and a half to two ounces of bonemeal per day. Bonemeal, fed in this way, is to be preferred to cattle licks.

VALUE OF FARMYARD MANURE.

In a recent address to the Victorian Branch of the Australian Institute of Agricultural Science, Mr. A. C. T. Hewitt gave some interesting estimates of the monetary value of farmyard manure based on 1942 fertilizer prices. Calculations show that a dairy cow annually excretes some 12 tons of manure and urine valued at £9 12s.; a dry cow or bullock 7 tons worth £6 16s. 6d.; a sheep 15 cwt. worth £1 8s.; a pig 1 ton worth 14s.; a draught horse 12 tons valued at £11 14s.; and a hen 56 lb. worth 7½d.

When organic matter is lacking in farm soils, the manures would have higher values than those given, since they supply soil-improving material which is absent from ordinary fertilizers.

These figures are worth bearing in mind not only by livestock raisers but also by agriculturists who do not engage in livestock production, since they are a pointer to the value of mixed farming in maintaining soil fertility.

IRRIGATION IN THE MARANOA.

In a report to Parliament, the Commissioner for Irrigation and Water Supply (Mr. T. A. Lang) states that the mass concrete weir now under construction on the Balonne River near St. George will, in addition to providing an assured water supply for the town of St. George, allow of the irrigation of about 1,000 acres of land for lucerne and other fodder crops and thus provide an experimental area for development of south western lands under irrigation.

The weir is 18 feet high and will impound 3,900 acre feet of water. Allowance is being made for raising the supply level a further 6 feet by the provision of crest gates which can be raised in times of high flow to avoid undue flooding.

DEVELOPMENT OF THE BURDEKIN.

Recent reports on the investigations into the water resources of the Burdekin River and their utilisation for agriculture indicate that a dam site at Burdekin Falls and a diversion weir site 20 miles down the river are being surveyed, and that a contour survey of lands that might be commanded from the diversion weir is being made.

Investigations to determine suitable pastures and field crops for the area are being made by the Department of Agriculture and Stock and the Commonwealth Council for Scientific and Industrial Research on the Department's Regional Experiment Station at Ayr, and C.S.I.R. is making a soil survey of lands that may be commanded. Irrigation technique is also being investigated.

Special attention is to be given to the irrigation of tobacco and sugar cane on Special experiment stations on the Burdekin.

J.F.O.'s First Anniversary.

THE Queensland Junior Farmer Organisation in its first year enrolled approximately 200 members, reports the Director of the Organisation (Mr. T. L. Williams).

During the year two special schools of instruction were held at the State Agricultural College at Lawes. It is hoped to increase this number to at least four in 1949. The schools have proved very popular with club members and many more were offering than could be accommodated. Lectures, practical demonstrations and film screenings have kept the students occupied, and the written examinations at the end of each school have indicated that much scientific and practical information has been gained.

It is intended to set up local supervising committees in each club area and to arrange for special field days on local farms for the purpose of demonstrating correct methods of farm and livestock management. Arrangements are also being made for members to attend field days organised by the Department of Agriculture and Stock.

Examination Results.

Results of the examination test conducted at the end of the second school of instruction are as follows: —

Group 1 (*over* 17).—Ronald Saville (Greenmount), and S. S. Dmitrieff (Thangool), 1st; E. W. Bellette (Thornlands), Les Dreger (Biloela) and John D. Puschmann (Plainby), 2nd; Ernest Esposito (Mt. Murchison) and Edward H. Jensen (Biloela), 3rd; Alf. Handley (Biloela), 4th; James P. Christiansen (Langmorn), 5th.

Group 2 (*under* 17).—Norman G. Madsen (Warwick) and L. W. Walsh (Southbrook), 1st; Douglas K. Madsen (Upper Freestone), Keith Shepherdson (Biloela) and Leslie R. Ralph (Ravensbourne), 2nd; M. J. Kerlin (Killarney), Basil Horne (Wondai) and Ralph E. Halliday (Ambrose), 3rd; Vincent E. Walker (Mondure), 4th; Norman Gustafson (Tannymorel), 5th; Ray Hopkins (Woodhill), 6th; Frank Mastroieni (Biloela), 7th; Stuart Ian Harris (Samford), 8th.

Care of Mother and Child.

Under this heading an article supplied by the Maternal and Child Welfare Service of the Department of Health and Home Affairs, dealing with the welfare and care of mother and child, is published each month.

SUNBATHING FOR INFANTS.

THE best places for sunbaths are on a well-protected veranda, in a room with the windows wide open, and, as the baby gets older, on the lawn. The best time to begin sunbaths is in the first warm weather, but if begun at this time of the year the early morning hours should be used. Winter babies should have sunbaths about midday.

When a mother has decided that the sun is just about the right heat for her baby's sunbath, she should expose just his arms and legs to the sun for about five minutes—once, and, later on, twice a day. By degrees the sunbath may extend to the waist and later on to the armpits. She should give half time to the front of his body and half to the back. Be careful in all cases to protect the head and eyes with a shady linen hat. The mother should hold the baby on her knee if possible so that while he is being sunbathed she can increase the activity of his circulation by stroking his limbs gently but firmly, starting at the hands and feet and working towards the body.

Watch the skin carefully and if the baby burns easily increase the time of the sunbaths slowly. With this method the baby's skin should gradually become tan and he will not burn so easily when holiday time comes round.

At the same time it is advisable to exercise care, especially if he is fair-skinned. A reliable sun-tan cream or oil should be spread over his skin before going on the beach, and it may be necessary to keep his body portected with clothing if it is found that he burns easily in spite of every precaution.

If sunburn does occur a soothing treatment in mild cases is to bathe the part with a strong solution of epsom salts in warm water, dry gently, and apply zinc cream. For severe burning an ointment which combines picric acid with a local anaesthetic is procurable and usually gives quick relief from the pain.

Any other questions on this and other matters connected with children may be obtained by communicating personally with the Maternal and Child Welfare Information Bureau, 184 St. Paul's terrace, Brisbane, or by addressing letters "Baby Clinic, Brisbane." These letters need not be stamped.

In the Farm Kitchen.

Cabbage Soup.

Ingredients: 1 head of white cabbage, 3 pints stock, ½ pint milk, 1½ oz. dripping, seasoning, 1 rasher of bacon, little flour or other thickening.

Wash the cabbage and shred finely. Put into a pan with just sufficient water to prevent sticking, cover and cook for 10 minutes. Drain well and return to the pan with the dripping and chopped bacon, cover and simmer for 20 minutes. Add stock, cover again, and cook gently for about an hour. Blend thickening to a cream with milk and stir into the soup, adding remainder of the milk. Cook until smooth and creamy.

Macaroni Soup.

Ingredients: 1 quart of stock, 6 oz. cooked macaroni, 1½ oz. grated cheese, ½ pint milk, seasoning to taste.

Cook the macaroni (with a small onion, if liked) in salted boiling water until tender, then remove half the macaroni and boil the remainder until pulpy. Add stock and milk to make 1 quart in all, then add the first quantity of macaroni and additional seasoning to taste.

Bring to simmering point and divide into portions, allotting an equal amount of grated cheese to each.

Quicker Cookery.

There is a quick way of doing most jobs and here are a few cookery wrinkles which you will find make for ease and speed. When making soup, grating raw vegetables is better than chopping them, because that way takes very much less time.

By mincing pieces of fat before putting them in the oven for rendering down more fat will be extracted in less time.

Flouring sandwich tins after greasing prevents sticking. Dredge in the flour and, turning and tilting the tin, give it several sharp taps with the hand.

For cutting rinds off bacon, fins off fish and the like, try using scissors instead of a knife. This method is much quicker and satisfactory.

Heating a tomato makes it peel easily. Hold a tomato on the end of a skewer in the heat for a minute or two, without scorching it. The tomato will then peel quite easily.

For covering a basin for steamed pudding, grease a square of greaseproof paper, cut to overlap the basin rim by three inches. Lay this greased paper over the top of the basin, fold the edges under and twist end of paper to fasten securely.

When chopping food and the like, keep the point of the knife firmly on the board all the time with the left hand. Chop by moving handle up and down sharply, swinging backwards and forwards in a semi-circle.

Salty Flavours.

A pinch of salt added to coffee brings out the flavour well.

A pinch of salt to every pound of fruit preserves the flavour of jam.

To stiffen the bristles of a hairbrush, add a pinch of salt to the washing water.

Many bottle-necked decanters defy the penetration of the brushes used for cleaning but salt, mixed with vinegar and tea-leaves, will make all clear. Allow the mixture to stand in the stained decanter for an hour or so, shake briskly, then stand the decanter in reverse. The same treatment may be used with jugs and all bottles.

If milk boils over on to the stove, scatter a little salt on the spot and the odour vanishes, or if the chimney catches fire, hurl a few handfuls of common salt on the burning soot and you may not have to seek further assistance.

For stains on the egg-spoons just rub with a damp cloth sprinkled with salt.

Stained china, sinks, aluminium saucepans, etc., all respond well to a good rub with common salt.

To clean a porcelain hand-basin or bath, try rubbing with salt and kerosene.

THE WEATHER DURING DECEMBER, 1948.

Although there were scattered ½-inch to 1½-inch falls over the Central Highlands on the 1st, rainfall in the early part of the month was confined chiefly to the Downs, South and Central Coast districts with several 1-inch to 2-inch falls on the Downs and South Coast Towards the middle of the month an isolated to scattered thunderstorm distribution commenced in the Carpentaria and extended through Central districts to the Warrego, Maranoa, and Downs, culminating in over 2-inch falls on the headwaters of the Dawson (Wandoan 293), and in some hailstorms on the Downs in the Bell-Oakey-Greenmount area on 15th A fairly general light to moderate distribution on the Downs and South Coast Moreton from 17th to 20th extended up the coast to give 2-inch to 4-inch totals on 23rd and 24th on the coastal belt from Home Hill to Cooktown. During the last week of the month general rain commenced along the Western and South-western border districts and by the 31st had extended eastwards to the Coast The Western and South-western districts and Warrego and Central Lowlands received the greatest benefit, many totals in these areas ranging from 3 inches to 6 inches and resulting in temporary flooding in Coopers Creek, Wilsons Creek, and the Bulloo and Paroo Rivers Local heavy falls of 4 inches to 5 inches in the Cloncurry-Granada area caused a temporary suspension of rail traffic. On the Maranoa and Downs general moderate to heavy 1-inch to 3-inch totals were registered and scattered over 2-inch falls were recorded on the Central and Coastal highland areas. In the dry areas of the Western and Central interior these rains were the most beneficial for the past two years Follow-up rains will be required next month in these areas to ensure good recovery from the protracted dry spell. For the month the Central Lowlands, Western districts, Darling Downs, Maranoa, Warrego, Peninsula South, and Lower Carpentaria all had over-average December rainfall. The Coastal districts were all below average, but the onset of monsoonal rains of 4 inches to 8 inches on the North and Central Coasts in the first four days of January have decreased rainfall deficiency in most parts of these areas.

Maximum temperatures for the State were mostly above overage (Dalby 90.6, plus 1.6, Mount Surprise 94.9, plus 0/2). Minimum temperatures were all above average, particularly in the Central Interior, where Longreach (70.9) was 3 4 degrees above normal. Many century readings were recorded inland particularly in the Western and North-western parts of the State.

RAINFALL IN THE AGRICULTURAL DISTRICTS.

DECEMBER.

(*Compiled from Telegraphic Reports.*)

Divisions and Stations.	Average Rainfall. Dec.	Average Rainfall. No. of years' records.	Total Rainfall. Dec., 1947.	Total Rainfall. Dec., 1948.
	In.		In.	In.
North Coast.				
Atherton	7·02	42	3·80	6·40
Cairns	8·53	61	1·53	6·91
Cardwell	7·95	71	6·89	4·94
Cooktown	6·53	67	4·35	3·39
Herberton	5·64	57	3·92	5·75
Ingham	6·77	51	1·12	5·14
Innisfail	11·16	62	2·61	4·55
Mossman	8·00	19	3·21	12·50
Townsville	5·33	72	1·33	3·30
Central Coast.				
Ayr	4·20	56	2·37	6·78
Bowen	4·49	72	1·16	4·76
Charters Towers	3·26	61	1·89	3·64
Mackay	6·86	72	2.96	4·47
Proserpine	7·72	40	1·37	4·03
St. Lawrence	4·67	72	2·13	2·42
Central Highlands.				
Clermont	3·77	72	3·07	1·24
Springsure	3·28	74	7.00	1·66
South Coast.				
Biggenden	4·85	44	1·64	2·81
Bundaberg	5·10	60	8·07	3·28
Brisbane Bureau	4·95	96	8·14	3·21
South Coast—contd.				
Caboolture	5 48	67	6·63	3·69
Childers	5·80	48	4·28	4·43
Crohamhurst	7·19	50	1·82	8·002
Esk	4·76	56	11·77	4·21
Gatton College	3·89	44	1·31	..
Gayndah	4·21	72	5·17	4·54
Gympie	5·40	73	6·06	4·86
Kilkivan	4·61	62	7·12	4·74
Maryborough	5·05	72	3·93	4·35
Nambour	6·65	47	6·61	8·31
Nanango	3·86	61	12·70	4·42
Rockhampton	4·67	72	4·43	2·55
Woodford	5·34	55	8·64	4·78
Darling Downs.				
Dalby	3·49	73	6·98	4·55
Emu Vale	3·52	47	7·73	5·14
Jimbour	3·44	64	3·39	3·54
Miles	3·17	58	6·82	7·35
Stanthorpe	3·56	70	6·00	3·59
Toowoomba	4·53	71	7·83	6·64
Warwick	3·50	78	7·05	6·12
Maranoa.				
Roma	2·59	69	4·33	3·44
St. George	2·09	62	3·80	3·44

(Weather and rainfall information supplied by Divisional Meteorologist, Brisbane.)

ASTRONOMICAL DATA FOR QUEENSLAND.

MARCH.

Supplied by W. J. Newell, Hon. Secretary of the Astronomical Society of Queensland.

TIMES OF SUNRISE AND SUNSET.

At Brisbane.			MINUTES LATER THAN BRISBANE AT OTHER PLACES.					
Day.	Rise.	Set.	Place.	Rise.	Set.	Place.	Rise.	Set.
	a.m.	p.m						
1	5.41	6.20	Cairns	31	27	Longreach	36	34
6	5.44	6.15	Charleville ..	27	27	Quilpie	35	35
11	5.46	6.10	Cloncurry ..	51	48	Rockhampton ..	10	10
16	5.49	6.04	Cunnamulla ..	29	29	Roma	17	17
21	5.52	5.59	Dirranbandi ..	19	19	Townsville ..	25	23
26	5.54	5.53	Emerald	19	19	Winton	41	39
31	5.57	5.48	Hughenden ..	35	33	Warwick	4	3

TIMES OF MOONRISE AND MOONSET.

At Brisbane.

Day.	Rise.	Set.
	a.m.	p.m.
1	6.32	7.12
2	7.23	7.39
3	8.14	8.05
4	9.07	8.34
5	10.01	9.06
6	10.57	9.42
7	11.56	10.24
	p.m.	
8	12.56	11.13
9	1.56	..
		a.m
10	2.54	12.10
11	3.47	1.14
12	4.35	2.22
13	5.17	3.33
14	5.56	4.43
15	6 32	5.52
16	7.08	7.01
17	7.45	8.09
18	8.25	9.17
19	9.09	10.25
20	9.57	11.31
		p.m.
21	10.50	12.35
22	11.47	1.32
23	..	2.23
	a.m.	
24	12.46	3.07
25	1.44	3.45
26	2.40	4.18
27	3.35	4.48
28	4.27	5.16
29	5.19	5.42
30	6.10	6.09
31	7.02	6.38

MINUTES LATER THAN BRISBANE (SOUTHERN DISTRICTS)

Charleville 27; Cunnamulla 29; Dirranbandi 19; Quilpie 35; Roma 17; Warwick 4.

MINUTES LATER THAN BRISBANE (CENTRAL DISTRICTS).

Day.	Emerald.		Longreach.		Rockhampton.		Winton.	
	Rise.	Set.	Rise.	Set.	Rise.	Set.	Rise.	Set
1	21	18	38	33	12	9	43	38
6	12	28	27	43	2	19	30	51
11	10	30	26	45	0	21	28	53
16	21	18	38	34	12	9	43	38
21	30	9	46	23	21	0	54	26
26	26	13	43	29	18	3	50	32
31	15	24	31	40	7	15	35	46

MINUTES LATER THAN BRISBANE (NORTHERN DISTRICTS).

Day.	Cairns.		Cloncurry.		Hughenden.		Townsville.	
	Rise.	Set.	Rise.	Set.	Rise.	Set.	Rise.	Set.
1	34	25	54	47	38	32	29	22
3	25	36	47	55	32	40	21	31
5	15	45	40	60	25	46	14	37
7	7	53	36	66	20	51	7	44
9	2	56	33	67	17	53	3	46
11	6	55	35	67	20	52	6	45
13	16	46	41	61	26	47	14	38
15	28	33	50	54	34	38	24	29
17	41	20	57	44	42	29	34	18
19	52	8	66	36	50	21	43	8
21	56	2	68	32	52	17	46	3
23	54	3	67	32	51	18	44	4
25	51	9	65	36	49	22	42	9
27	42	19	58	43	43	28	35	17
29	32	29	52	50	36	35	26	25
31	21	39	44	57	29	42	18	34

Phases of the Moon.—First Quarter, 8th March, 10.42 a.m.; Full Moon, 15th March, 5.03 a.m.; Last Quarter, 21st March, 11.10 p.m.; New Moon, 30th March, 1.11 a.m.

On 21st March at 9 a.m. the Sun will cross the equator—Equinox—and on this day it will rise and set at true east and true west respectively. On the 2nd, 15th, and 29th the Moon will rise and set approximately at true east and true west respectively.

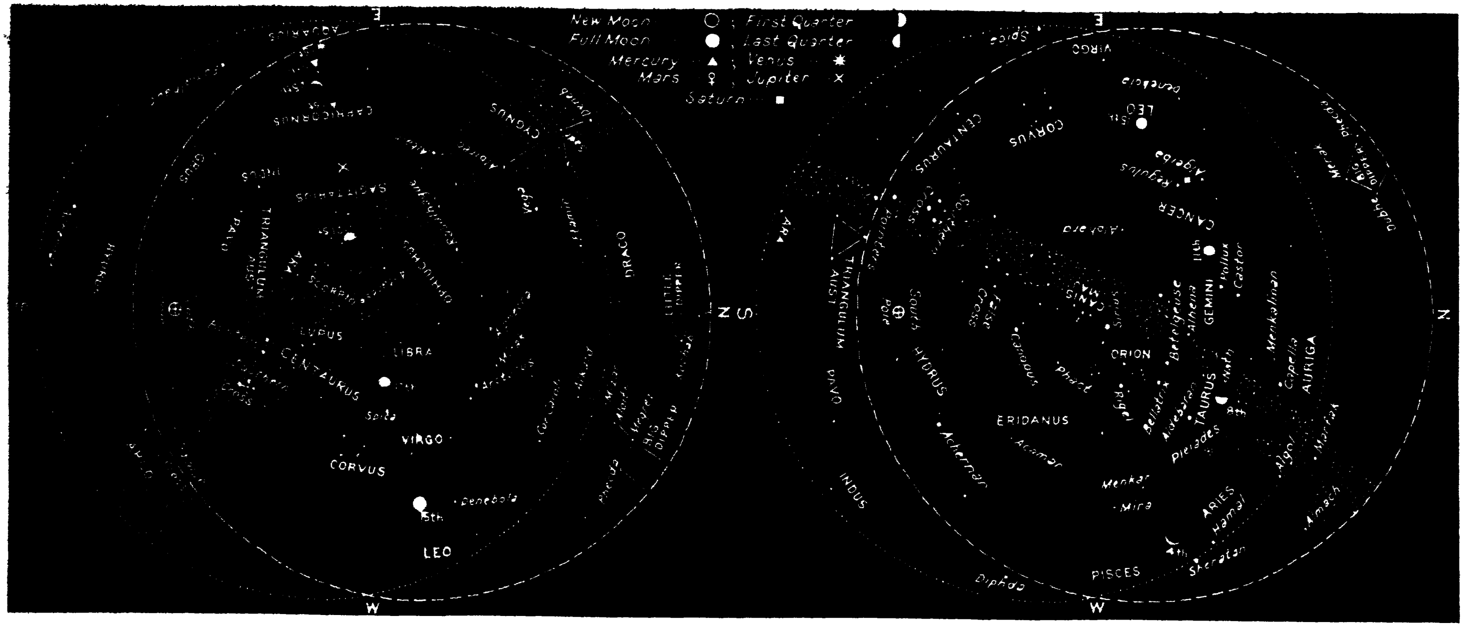
Mercury.—A morning object all this month and on the 1st, in the constellation of Capricornus, will rise 2 hours before the Sun, while by the 31st it will have reached the constellation of Pisces and will rise about 1 hour before the Sun.

Venus.—Now too close in line with the Sun for observation.

Mars.—Also too close in line with the Sun for observation.

Jupiter.—In the constellation of Sagittarius, at the beginning of the month will rise between 2 a.m. and 3.15 a.m. and at the end of the month will rise a little after midnight.

Saturn.—Now the only naked-eye planet visible in the evening. In the constellation of Leo, at the beginning of the month will be above the horizon before Sunset and by the end of the month will set between 2.45 a.m. and 4 a.m.



Star Charts.—The chart on the right is for 7.15 p.m. in the sou'h-east corner of Queensland to 8.15 p.m. along the Northern Territory Border on the 15th March. (For every degree of Longitude we go west the time increases by 4 minutes) The chart on the left is for 9 hours later. On each chart the dashed circle is the horizon as viewed from Cape York and the dotted circle is the horizon for places along the New South Wales border. When facing north hold "N" at the bottom; when facing south hold "S" at the bottom, and similarly for the other directions. Only the brightest stars are included and the more conspicuous constellations named. The stars which do not change their relation to one another, moving east to west, arrive at any selected position about 4 minutes earlier each night Thus, at the beginning of the month the stars will be in the positions shown about 1 hour later than the time stated for the 15th and at the end of the month about 1 hour earlier than that time. The positions of the moon and planets, which are continually changing in relation to the stars, are shown for certain marked days When no date is marked the position is for the middle of the month

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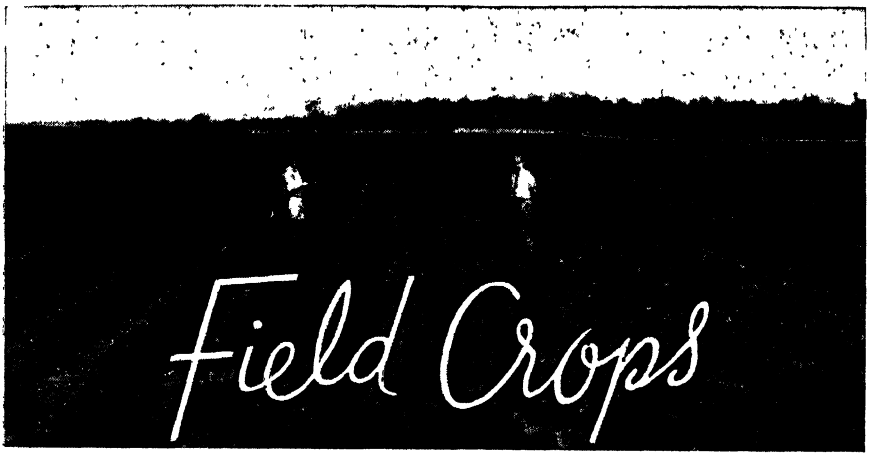
3

Contents



Fodder Conservation in the United States.*

C. J. McKEON, Director of Agriculture.

FODDER conservation is practised on a very extensive scale in the United States, climatic conditions making this essential in most States where severe winters are experienced. It would be the exception to visit any farm on which livestock were kept and not find at least one large tower silo. These are filled each season chiefly with chaffed maize, which, as is the case in Queensland, is by far the most popular crop for ensiling. In addition to silage, large quantities of lucerne and cereal hay are produced and stored in bales.

For the harvesting of silage crops, ensilage harvesters are now used very extensively, these machines cutting and chaffing the crop and depositing it in a box wagon which is drawn beside the ensilage harvester while it is operating in the field. The chaffed material is transported from the field to the silos, where a blower is used to convey it into the silos.

Of the hay crops, lucerne is one of the most important and is grown over a large area in a number of different States and under a very wide range of climatic conditions. Every operation associated with the production of lucerne hay, from cutting to loading either the baled or the loose hay on the lorry, is done mechanically on a large proportion of farms. This makes it possible for individual growers to produce on a large scale and at a low cost.

Pick-up balers are now used very extensively and machines are being successfully operated in which wire is used for twitching in place of twine which was previously used. One of the early disadvantages of the wire twitch was that the twitch was too short, with the result that ties frequently came undone. This has now been overcome and the balers have been adjusted to make a much longer twitch. One machine I saw operating was turning out bales of approximately 65 lb. each at the rate of one every 10 seconds.

* These notes are explanatory of photographs taken by Mr. McKeon during a visit to the United States as a member of a committee investigating the soy bean industry.

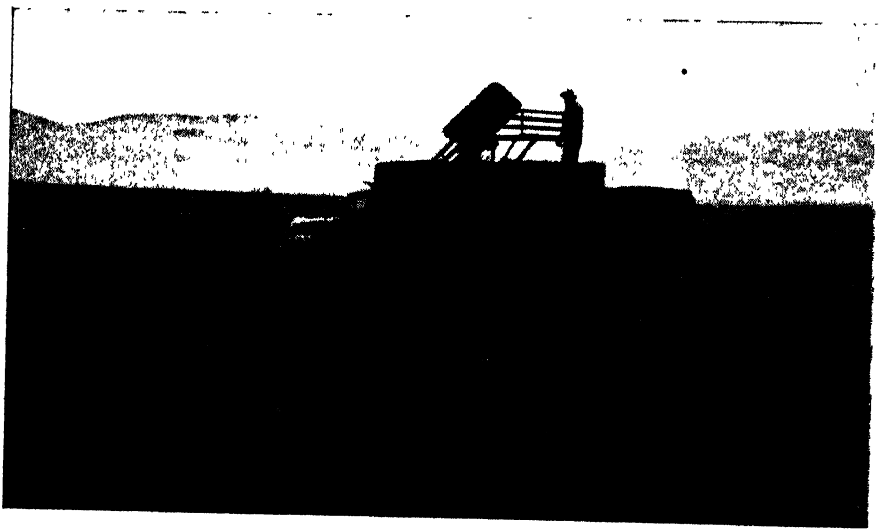


Plate 32.
A MECHANICAL BALE LOADER IN OPERATION.

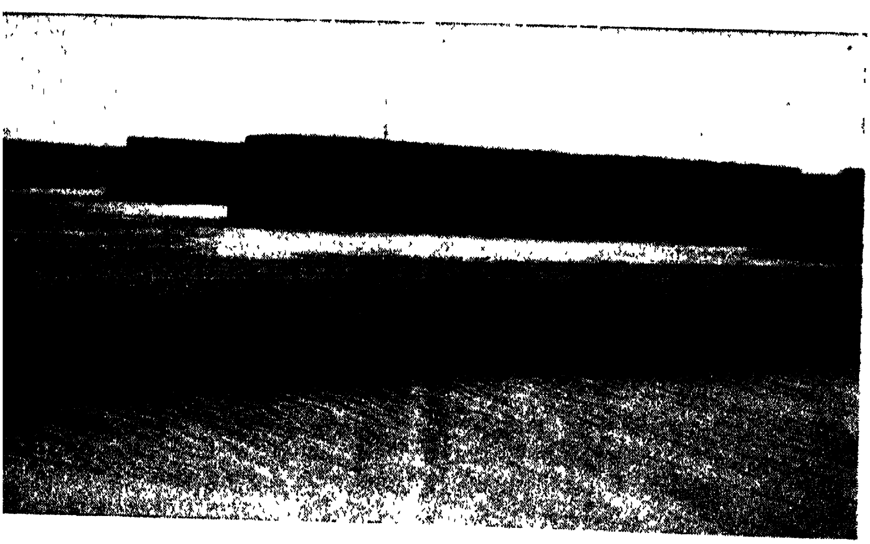


Plate 33.
STACKS OF BALED LUCERNE HAY.

Plate 34.

DEHYDRATION OF LUCERNE.—Cutting and windrowing the crop with a power mower with windrowing attachment.

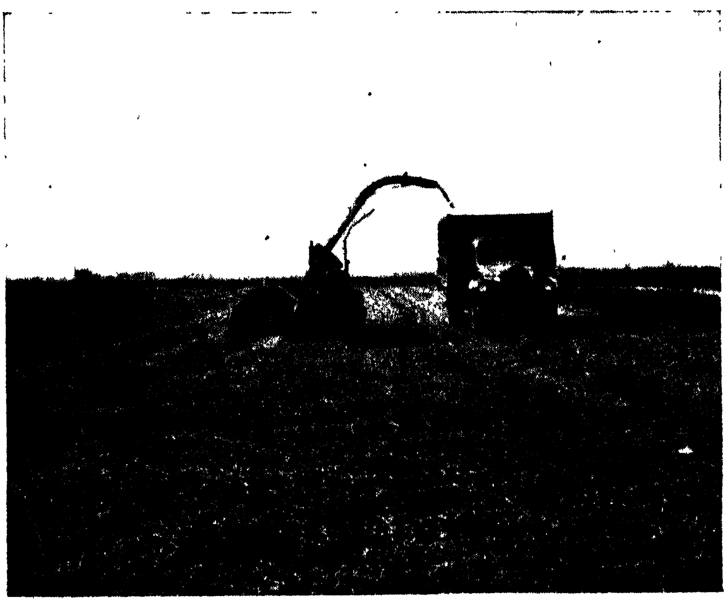


Plate 35.

DEHYDRATION OF LUCERNE.—Lucerne being picked up from the windrow, chaffed and elevated into a box wagon.

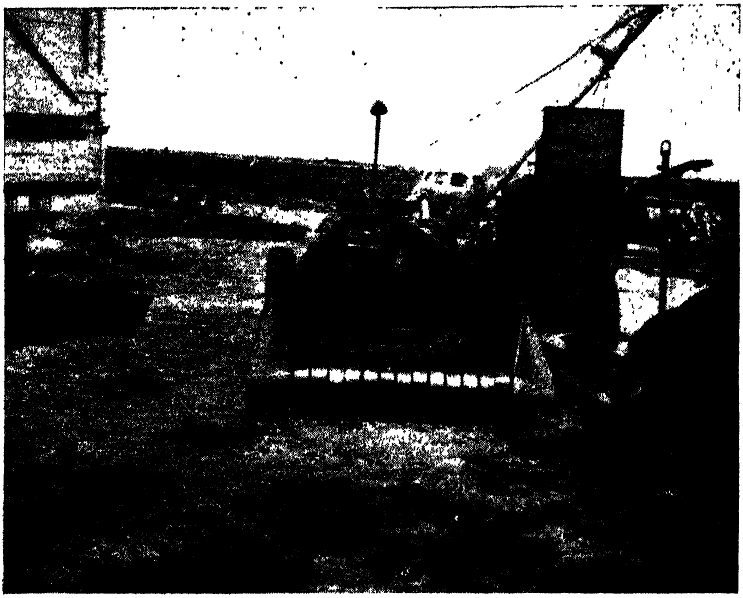


Plate 36.
DEHYDRATION OF LUCERNE.—Close-up of the lucerne chopper and elevator.

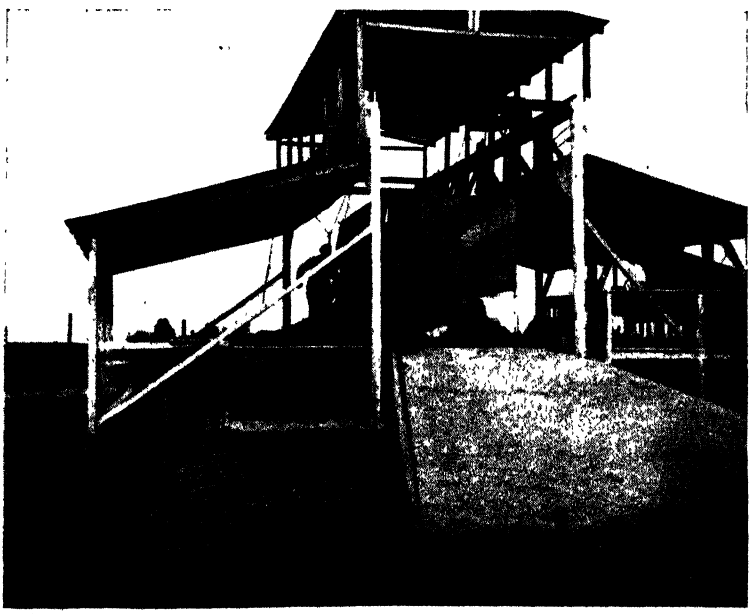


Plate 37.
DEHYDRATION OF LUCERNE.—Chopped lucerne being received at the dehydration plant.

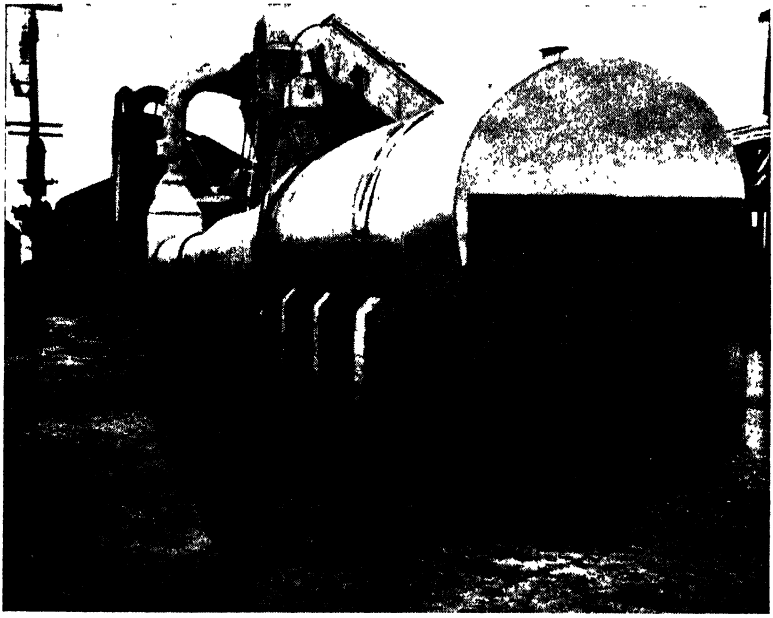


Plate 38.

Dehydration of Lucerne.—Portion of the dehydration plant, showing the first cylinder, in which the moisture content is reduced to about 25 per cent.

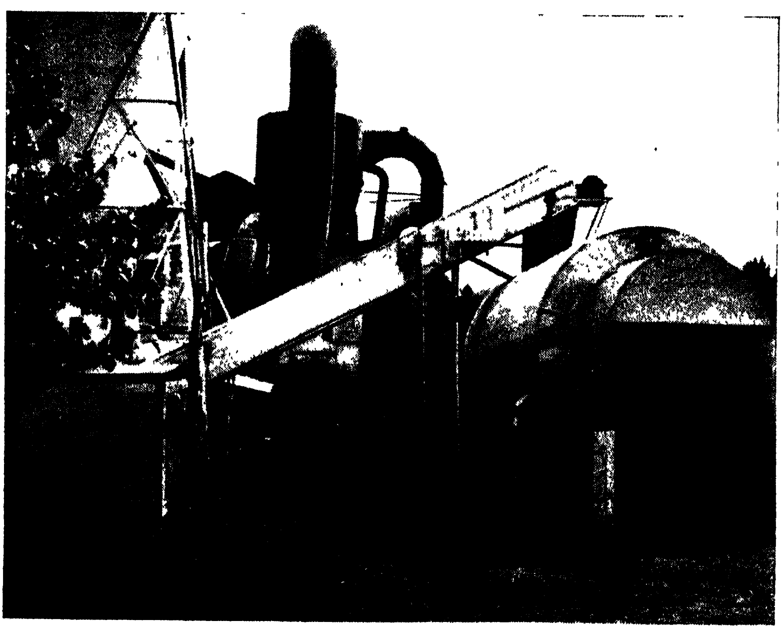


Plate 39.

Dehydration of Lucerne.—Portion of the dehydration plant, showing the second cylinder, in which the moisture content is reduced to about 10 per cent.

Loading of the bales on to the lorry is also done mechanically. Several different machines are in use for loading both bales and loose hay.

Lucerne is also used extensively for the preparation of dehydrated meal, which is quite an industry in some localities.

One particularly fine dehydration plant was seen in operation in the San Joaquin Valley, California. This plant had been installed about three years and was operated by 13 farmers, who received a flat rate per ton for the green lucerne and at the end of the year shared in the profits. The plant, which I was told cost 200,000 dollars, is claimed to be the largest ever built.

The lucerne is cut in the field with a power-driven mower with a windrowing attachment at the back of the knife blade. Immediately following the mower is a machine which picks up the cut lucerne, chaffs it and elevates it into a box wagon which is drawn beside the machine. The chaffed material is immediately taken to the dehydration plant and within eight minutes of its entering the plant is in the bag as a very fine meal.

The chaffed material is first passed through a cylinder, approximately 100 feet long and five feet in diameter, through which air heated to 1800°F., is drawn at the rate of 40,000 cubic feet per minute. Oil is used for heating. After passing through the first cylinder, the moisture content has been reduced to approximately 25 per cent. and the material is then elevated to a second tunnel of approximately half the length but at least twice the diameter, where the moisture is reduced to approximately 10 per cent. The dried material is passed through the hammer mill and bagged.

The plant works for nine months of the year, 24 hours a day, and turns out meal at the rate of approximately four tons per hour. The price of the meal, which has a guaranteed minimum protein content of 17 per cent., at the time of my visit was about 54 dollars a short ton.

It was not possible to obtain any figures relating to production costs.

WASHINGTON WHITEWASH.

A whitewash used overseas for painting lighthouses and other exposed buildings consists of three parts of cement and two parts of clean white sand mixed thoroughly with fresh water.

The wall should be wet and cleaned with fresh water, followed by the immediate application of the cement wash. This wash should be kept well stirred and should be as thick as can be conveniently applied with a whitewash brush.

A GOOD WHITEWASH.

Dissolve 2 lb. of ordinary glue in 7 pints of water. When dissolved add 6 oz. of bichromate of potassium, dissolved in a pint of hot water.

Stir the mixture well, add sufficient whitening to make it up to the usual consistency, and apply with a whitewash brush as quickly as possible. This dries in a very short time and, by the action of light, becomes converted into an insoluble waterproof substance which does not wash off even with hot water. It may be coloured to any desired shade by the use of a small amount of aniline dye or powdered colouring.

Subsoil Moisture for Callide Valley Wheat Crops.

R. W. GEORGE, Experimentalist, Biloela Regional Experiment Station.

IN view of the many excellent crops of wheat which were produced in the Callide Valley during 1948, it may be profitable to examine the probable reasons for such yields.

1948 Rainfall Conditions.

In most cases the wheat was planted either just after or just before the 3½ inches of rain which fell in mid-June. One-and-a-half inches of rain were received during the first week of July, but no further useful rain was recorded until after the crops had been harvested in the latter part of October and early November. This total of 5 inches of rain by itself would not have been sufficient for the growth of a successful wheat crop, even if run-off and evaporation losses were nil and all of the 5 inches of rain ultimately became available to the plants. Consequently, a considerable amount of moisture must have been already stored in the soil prior to the mid-June rain.

Flood rains occurred in early March and a further very useful rain group was recorded in late April and early May. Where ploughing operations were carried out by the middle of March a considerable portion of the moisture added to the soil by the flood rains remained stored in the soil. The 4½ inches of rain which fell in early May added considerably to the amount of moisture already stored in the soil, and the mid-June rain was also extremely useful in this connection.

On the basis of tests carried out at the Biloela Regional Experiment Station, at the end of June the average depth of soil containing moisture to field capacity was 3 feet 6 inches to 4 feet. As no useful rain fell from early July onwards, the moisture requirements of the wheat crop were met entirely by the moisture which was already present in the soil by the time the plants were a few inches high. Investigations made at this centre showed that all of the available moisture in the top 4 feet of soil had been utilised by the time the crop was approaching maturity with an average yield of 38 bushels per acre.

It is realised that the rainfall received during the March-June period of 1948 was considerably above average, but it must be remembered that severe drought conditions were experienced during January and February. One important feature of the rainfall received during March-June was that it occurred in rain groups of at least 3 inches at a time. Consequently, each successive rain group was able to thoroughly remoisten the surface layers of the soil and also to add some moisture to the subsoil zone. If this rain had been received in more scattered and lighter falls then the losses by evaporation before planting time would have been much higher.

Importance of Clean Fallowing.

Under the soil and climatic conditions of the experiment station, it has been demonstrated that in a clean fallow the loss of soil moisture by evaporation from below 8 inches is extremely slight even during a

fairly hot and dry six months' period. However, in the presence of any plant growth, either crops or weeds, any moisture reserve in the soil is quickly removed by the plants. Consequently, if soil moisture is to be successfully stored in the soil for a period of several months it is essential that all plant growth be kept at a minimum during that period.

An examination of the experiment station's rainfall records for July, August, and September reveals that in only a few years since operations were commenced there in 1924 would the rainfall received during these months have been sufficient to promote a satisfactory growth of a crop of wheat for grain purposes. The average rainfall for this three months' period is only 2.89 inches. During most of the seasons experienced at this centre, the amount of moisture which could be stored in the soil from January till June would be sufficient, however, for the successful growth of wheat crops. The average rainfall for this six months' period is approximately 17 inches.

Preparation of the Land.

Judged by the foregoing, it would appear that the successful growing of wheat in the Callide Valley depends upon the ability of the farmer to ensure that an adequate supply of moisture is stored in the soil by the time the crop is planted. The amount of rainfall received during the wet season, which is normally in January and February, is generally sufficient to wet the subsoil to a depth of at least 3 feet. If the land intended for wheat growing is ploughed as soon as possible after this late summer rain, most of that moisture will be retained in the soil. By ploughing immediately after the main wet period, it would be easier to control weed growth than if the land were ploughed early in January. For successful results, however, the land must be ploughed before the weeds are able to use much of the moisture which is added in the wet season.

In places where the risk of erosion during summer storms is only very slight it may be advantageous to plough the land during early January and then leave it in a rough condition till the end of the wet season. The maximum absorption of the heavy rains during this period would be effected by having the land in a very rough condition. In this connection, most soils in the Callide Valley do not require extensive and frequent cultivations to prepare a suitable seed-bed and too many cultivations cause a fairly rapid deterioration of the soil structure, with a subsequent loss of its absorptive qualities. Following the wet season the land could be given a shallow ploughing during March, using either a Sundercut or a standard plough. It should not be very difficult to control weed growth after this second ploughing. The essential point to keep in mind is that the maximum possible amount of the wet season and late summer rainfall must be retained in the soil, and this can only be achieved if plant growth is subsequently kept fairly well in check.

Early Varieties Desirable.

Many of the standard Queensland wheat varieties have yielded quite well under Biloela conditions, but in most seasons the earlier maturing varieties give better results than the later maturing ones.

The Mango.

S. E. STEPHENS, Horticulturist, Horticulture Branch.

IN point of antiquity the mango rivals most other fruits, and it appears to have occupied the same relative position in the culture of the tropical oriental regions as the vine and apple have in the more temperate lands. De Candolle, a famous botanist of the eighteenth and nineteenth centuries, who studied the subject closely, expressed the opinion that its cultivation extends over a period of 4,000 years or more; its relationship to Hindu religion and mythology certainly indicates great antiquity.

In historical times, references in literature to the mango have been frequent. It must have been a common tropical fruit from the earliest times of the Christian era as it has been remarked upon by many travellers, both ancient and modern. Its antiquity is so great and its cultivation so widespread that its origin is rather shrouded in mystery. De Candolle was satisfied that south-eastern Asia (and possibly southern India) is the natural habitat.

BOTANY.

The tree belongs to the family *Anacardiaceae* and consequently is related to the tar tree and the cashew. In common with its relatives, it possesses a caustic sap; the evidence of this is visible on children during the early part of the mango fruiting season when mango sores, caused by contact with the sap of immature fruit, develop on exposed parts of the skin. The generic name is *Mangifera* and the specific name of the commonly cultivated tree is *indica*. Altogether some 40 species of *Mangifera* are recognised by botanists, the majority occurring in south-eastern Asia.

Races and Varieties.

Over many centuries the mango has been very largely propagated from seed, and, owing to a peculiarity of the seed, certain types have perpetuated their characters from generation to generation with but little change. These have become known as races. From time to time an outstanding tree in one or other of these races has been propagated by budding, grafting or inarching and has then become a horticultural variety of the race.

In some countries vegetative methods of propagation have been followed so long that the original races have been almost lost to sight. This is not the case in Queensland, however, where propagation is almost entirely from seed. Consequently, several races may be clearly recognized. Of these, the most widely grown is the one known as the "Common" mango. It is cultivated along the whole of the eastern coast and exhibits uniform racial characters throughout. The tree has usually an oval head; the foliage is dense and the leaves of medium size. The fruit is long, always yellow-green in colour, has an elevated stem attachment and is thin-skinned and very fibrous but sweet and well flavoured.

A second race, well known but by no means so commonly grown, is the "Peach" mango. This has a shorter fruit than the Common, with the stem set in a depression, the skin highly and attractively coloured, the flesh fibrous and the flavour turpentine.

A third race now becoming very widely grown is what is often called the "Apple" mango, but which on the market is known as the "Kensington" or "Bowen" variety. The following is a brief description of the tree and fruit of this variety:—Tree shape, oval. Leaves with a characteristic sweet scent when crushed. Fruit weight about 15 ounces, size $4\frac{1}{2} \times 3\frac{3}{4} \times 3\frac{1}{4}$ inches. Skin of fine texture, bright orange-yellow with red-pink blush over base and exposed faces of the fruit. The stem is in a slight depression and the fruit is grooved ventrally from stem to the prominent nak. When young the apex of the fruit is distinctly wedge-shaped when viewed from the side, while from the face it has a prominently-squared beak. As the fruit matures the apex fills out and rounds off and the beak becomes less pronounced. Flesh of the ripe fruit is thick, of rich orange colour, free of fibre, and of rich, pleasant flavour. It is a mid-season variety.

Other races of minor importance exist in Queensland but they do not warrant enumeration.

Overseas countries recognize races of their own as well as imported races, such as West Indian, Alphonse, Cambodiana, Mulgoba and Sandersha, but the common Queensland races are not referable to any or these.

Description of the Tree.

The mango tree is evergreen and densely foliaged and possesses few rivals as a shade tree. Growth of the tree is vigorous and a mature seedling may reach a height of 50 or 60 feet with a branch spread of about the same and a trunk girth of 10 to 15 feet. Odd trees exceed even these measurements, which, for a fruit tree, are large, and W. Popenoe, an American authority on tropical fruits, reports a specimen in Brazil having a branch spread of 125 feet and a trunk girth of 25 feet.

Trees vary somewhat in shape, particularly in the case of seedlings, but usually those of the same seedling race have similar growth habits. Some races are tall, upright growing and narrow (Plate 40), others have a round or oval head (Plate 41), and others again have a broad base and a tapering, pyramidal top (Plate 42).

The leaves are simple and entire, often up to 15 inches long and seldom more than $2\frac{1}{2}$ to 3 inches wide. They are borne on the branchlets in large numbers. Flowers are borne in large terminal panicles containing possibly several thousand flowers in all, but seldom more than two or three mature fruits result from the flowers on each panicle.

Plate 40.
Mango Tree of Tall Habit.

Plate 41.
A Round-headed Mango Tree.

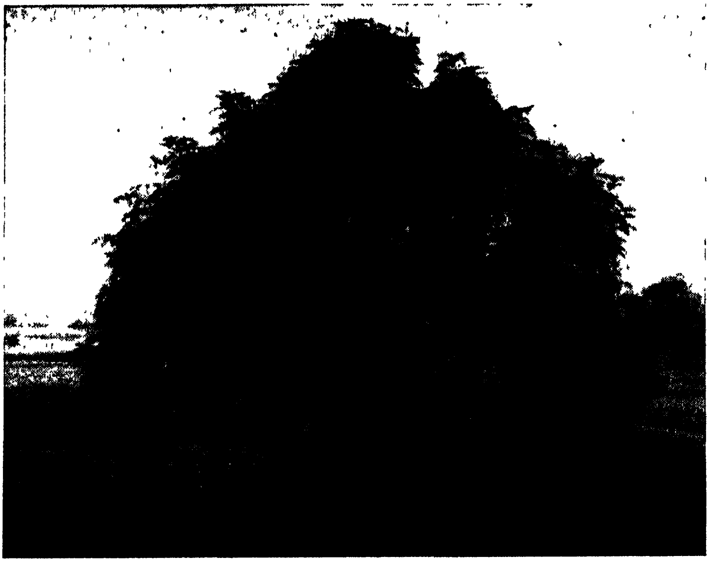


Plate 42.
PEAR-SHAPED MANGO TREE.

Description of the Fruit.

Fruits vary considerably in size, shape, colour, fibre and flavour just as do varieties of apple, pear and many other fruits. They possess several general characters, however, that differentiate them from other fruits, and since it is upon these characters that the varieties are distinguished it is necessary to become familiar with the terminology relating to mango fruit. Plate 43 shows the outline of two typical mango fruits with the features marked. It will be observed that a mango is always described with the "nak" or stigmatic point facing the left.

The fruit does not develop symmetrically about the stem, hence the various features that are delineated in Plate 43. The stigma is not situated at the apex but always to the ventral or left side and at various distances from the apex according to the variety. The ventral shoulder always develops to a greater extent than the dorsal shoulder, but below the shoulders the ventral side is usually concave whilst the dorsal side is strongly convex. The distance between the dorsal and ventral shoulders is known as the major diameter and the line through the fruit at right angles to this (not shown in the sketch) is the minor diameter. The base of the fruit may be depressed when the stem is set in a saucer-like depression, or it may be elevated when the stem is set on a raised attachment.

Fruit colour is an extremely variable factor. The basic variation between varieties or races is often very great, for whereas some kinds retain a uniform yellow-green colour when ripe, others are a rich orange colour, others straw coloured, others again a uniform deep red, while yet others display a combination of two or more of these colours. These are the general varietal or basic colourations but environmental factors will also bring about variations in the colouration of fruit within a variety.

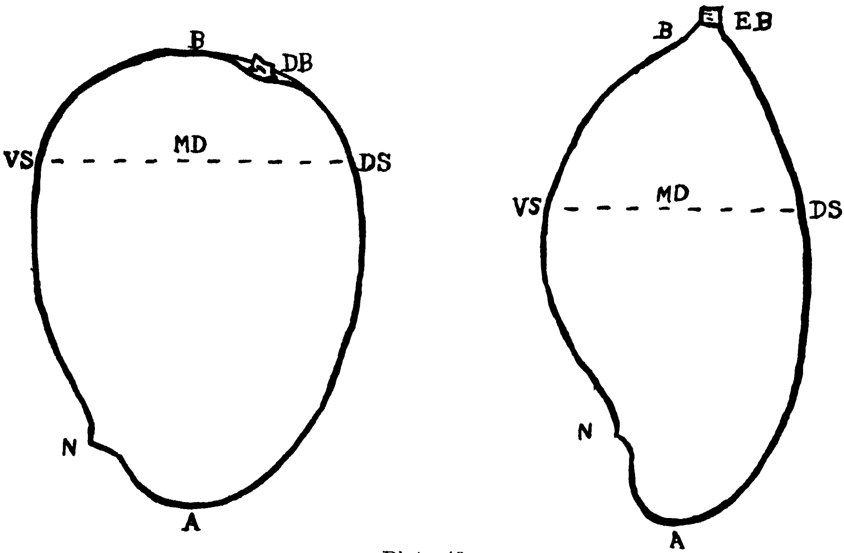


Plate 43.

THE FEATURES OF A MANGO FRUIT.—A—Apex; B—Base; DB—Depressed base; EB—Elevated base; N—Nak; VS—Ventral shoulder; DS—Dorsal shoulder; MD—Major diameter.

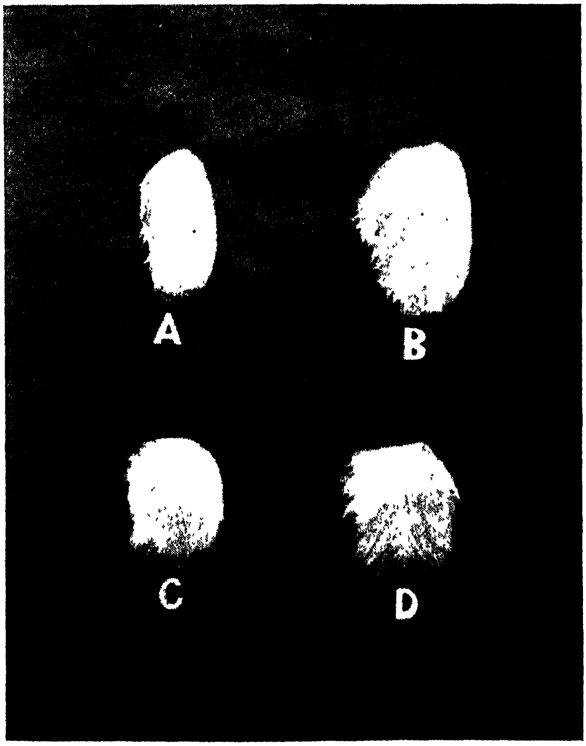


Plate 44.

DEGREES OF FIBROUSNESS IN FOUR TYPICAL MANGO VARIETIES.—A and B, unnamed varieties under trial; C, Kensington; D, Common fibrous type.

Flavour is almost as variable as colour but it remains constant for any variety under any given conditions. It varies from insipidly sweet and fragrant at one extreme to strongly acid and odoriferous at the other, and includes in the less desirable range fruits of varying degrees of turpentine flavour and odour. On the other hand, many races and varieties possess a sugar-acid ratio and a bouquet that make them highly desirable fruit and justly popular.

Fibre content is an important feature in the mango. It completely outweighs flavour, since when fibre content is high, it reduces even the best flavoured fruit to an unmanageable problem at the meal table. Fibrousness is a condition of the seed, and as the length and number of fibres on the seed increase the suitability of the fruit for eating purposes decreases. Complete absence of fibre is the most desirable condition for edibility, but a fruit lacking all fibre would be of poor carrying quality and hence of indifferent market value. Plate 44 shows the amount of fibre in fruit of four different varieties, A and B being two North Queensland varieties under trial by the Department of Agriculture and Stock, C the Kensington widely grown in the Bowen district for market sale, and D a common fibrous type.

Growth Habits.

A mango tree makes several bursts of growth during the year, each of these (known as a "flush") taking place from the terminal of the previous growth. The young shoots are very tender growth, and are usually either red or yellow in colour. After shoot elongation is complete, and the leaves have attained mature size, the colour changes to normal green. The period of flush growth extends over three or four weeks and is followed by a period of inactivity before the commencement of the next flush. The flushes do not seem to occur at any fixed periods. In fact, it is quite common for flush growth to occur very unevenly on a tree, some branches being in active growth while others are dormant.

Mango trees are seldom completely dormant, but immediately following the harvesting of the crop a period of some weeks of reduced growth usually occurs.

Tree Growth and Flowering Relationship.

It has been observed by a number of investigators that mango flowers are produced only on one-year-old wood, and mainly on the wood shoots that grew in the early part of the season. Shoots that are produced later in the year either do not flower at all or produce only weak flowers that fail to set any fruit. If a tree produces a large amount of wood growth late in the season—that is, shortly before the flowering period—then such a tree will produce very few flowers that season. It follows that weather conditions which favour early growth, and an early cessation of growth, are needed for good cropping.

Providing the normal cycle is not upset by disease or pests or by abnormal weather conditions, it should be possible to forecast with some degree of reliability the likely amount of flowering in the approaching season.

It has also been observed that fruit production is always at the expense of vegetative growth. A shoot that sets and matures a fruit will not produce a vegetative shoot in the same season, but one which

flowers and fails to set any fruit will often produce a vegetative shoot later in the season. Consequently, if a tree was to carry a fruit on every shoot (which, of course, does not occur), it would make no new vegetative growth that year and would have no fruit the following year.

It is not possible to determine, before the terminal buds commence to swell, which will be flower buds and which vegetative or wood buds. However, external differentiation is noticeable within a short time of bud movement. The characters that distinguish the two types of bud are illustrated in Plate 45. The flower bud develops a distinct beak, whereas the wood bud remains slender and straight.

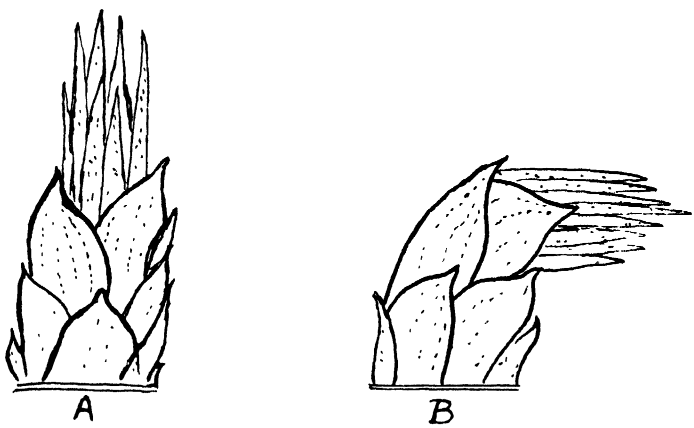


Plate 45.

BUD DIFFERENTIATION AT EARLIEST STAGE OF GROWTH FLUSH.—Fig. A.—Initial growth of a vegatative shoot bud. Fig. B.—The same growth stage of a floral shoot bud.

Flowers.

Flowers in the mango are produced in the form known as a panicle; and a panicle may carry as many as 3,000 to 4,000 flowers or as few as 200 to 300. The form of panicle may vary considerably in different varieties. Sometimes the central axis is short and the primary laterals short and stiff; on other varieties the main axis may be as long as 20 to 24 inches and the primary laterals also long and drooping. The longest laterals are always grouped round the base of the axis; as the apex is approached they become progressively shorter. The flowers customarily mature progressively from the base to the apex of the panicle.

The individual flowers are small—about one quarter-inch in diameter. They are either staminate (male) or perfect (bisexual). As a rule, most are staminate, the percentage sometimes being as high as 98, but in some varieties the perfect flowers may be almost as numerous as the staminate. The perfect flowers are distinguished by the presence of a small globose ovary surmounting the disc located in the centre of the corolla. In the male flowers the disc is present but the ovary is wanting.

Pollination and Fruit Setting.

Flowers are scented and also produce nectar; consequently they are attractive to insects, indicating that the tree is insect pollinated. The honey bee is not a frequent visitor to mango flowers so plays a very minor part in the pollination of this fruit. The chief visitors, in order of frequency, are flies of many kinds, wasps, butterflies and beetles. Notwithstanding the numerous insect visitors, the percentage of effective pollinations is low. In most varieties grown in Queensland the number is seldom more than two on a panicle; more frequently it is only one.

It is common for the perfect flowers to outlive the staminate, and the ovary may even commence to swell but effective pollination may not have occurred and the flowers eventually wither and fall.

Fruit setting is more frequent near the apex of the flower panicle than on the primary laterals near its base. This accounts for the elongate stem upon which mango fruits are usually borne.

Seed Characteristics—Monoembryony and Polyembryony.

Reference has been made above to the peculiarity of the seed of some mangoes. This condition is known as polyembryony.

The great majority of horticultural plants produce but one seedling from each seed, this being the result of the union of a sperm and ovule, and hence a sexual cross. Such seeds contain but one embryo and are termed monoembryonic. In the production of this seed, pollination may have been effected within the one flower, when the seedling tree will be similar to the parent; alternatively, different flowers, possibly from different trees, may be involved in the pollination, in which case the seedling is likely to exhibit marked differences from the parents. This applies particularly to many of the choice Indian varieties. Thus these good varieties could not be depended upon to reproduce themselves and Indian gardeners found it necessary to develop the vegetative propagation method known as inarching.

Polyembryony is a characteristic of the seedling races of Queensland, the Philippines, Cambodia and other places. A polyembryonic mango produces several plants from each seed, due to the habit of buds being produced on the seeds in the same way as on the branches. A shoot from a seed bud, being vegetative growth, is identical in race characters with a shoot from a branch bud of the same tree.

It is necessary, of course, for flowers of polyembryonic mango trees to be pollinated to obtain fruit setting; consequently, the seeds also contain the germ of a sexual cross. However, in most cases the growth of this embryo is suppressed by the development of the vegetative buds. Occasionally it does grow and develop into a seedling; should that occur, the seedling cannot always be differentiated from the vegetative plants. When such a plant is set in the field with the others it will, in the course of time, exhibit more or less variation from the racial type either in tree growth or in fruit characters, or in both. The tree has foreign characters in its make-up, due to the sexual cross, and consequently is "off type."

Plate 46 illustrates the vegetative growth that results from monoembryonic and Plate 47 that from polyembryonic seeds.

Plate 46.
GROWTH FROM A MONOEMBRYONIC MANGO SEED.

Plate 47.
GROWTH FROM A POLYEMBRYONIC MANGO SEED.

Rooting Habits.

In the early seedling stage of growth, tap root development is the main feature of the root system, elongation of the tap root exceeding aerial growth of the plant. In later life the emphasis on deep root growth continues, anchor roots being thrown down at frequent intervals from the surface rooting system. Such roots extend to many feet in depth. In the Bowen district the evidence of tree growth appears to point to the deep roots descending to at least 18 feet. This is based on the fact that trees during their early years are pale and sparse in foliage due to shortage of soil moisture, but, after they have reached

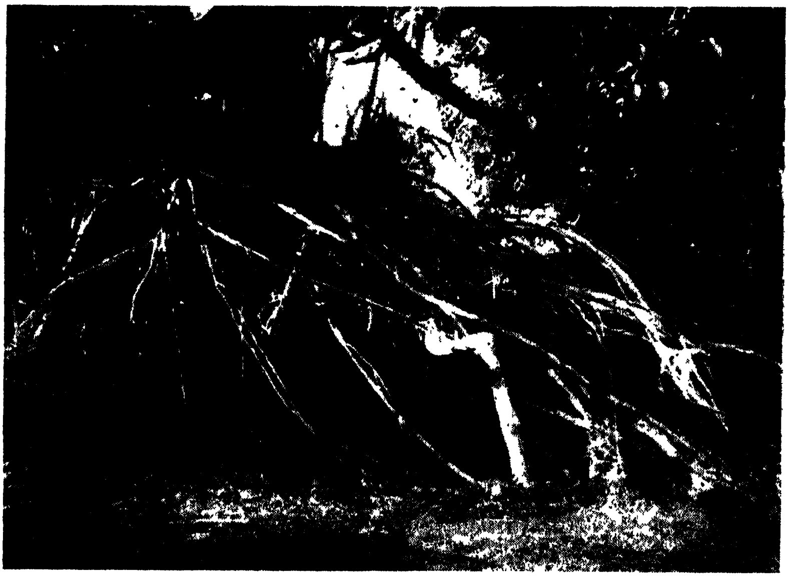


Plate 48.
MANGO TREE WITH PORTION OF ROOT SYSTEM EXPOSED SHOWING THE PROFUSE ROOTING HABIT.

the age of five or six years with corresponding increase in size, the foliage becomes dense and dark green, apparently indicating that the roots have reached the water table which in that district is situated at about 18 feet.

In addition to the anchor roots, the trees have a dense network of roots extending widely through the surface soil. Plate 48 illustrates part of the rooting system of a mango tree. Due to the erosion of a bank upon which this particular tree was growing, approximately half the root system to a depth of about 10 feet was clearly exposed. The ramifications of root development are well illustrated.

CLIMATIC REQUIREMENTS.

The mango is a tropical species and it is only well within the tropics that it may be found growing naturally in competition with the native flora. Such a condition exists in many parts of the coastal

area of North Queensland. However, under conditions of garden care or orchard culture the tree can be grown quite successfully in the sub-tropical region of southern Queensland and in the highland parts of North Queensland. It is not frost hardy, so should not be planted where it would be regularly subjected to freezing temperatures. In places that may experience light frost of one or two degrees at long intervals the tree usually can be established by giving it protection during the early years of its growth. When mature, it can more successfully withstand a few light ground frosts. However, where freezing temperatures are experienced with more or less regularity it is useless to attempt to grow the tree, since the young wood, upon which the fruit is produced, would be regularly destroyed.

There is no critical maximum temperature for the mango; it thrives under the hottest conditions.

Rainfall, particularly in respect to its seasonal incidence, is as important in fruit production as temperature is in tree growth. The amount of annual precipitation may vary between wide limits without adversely affecting cropping. In North Queensland, the Bowen district, with an average annual rainfall of approximately 30 inches, and the Cairns district, with an average of approximately 90 inches, both produce heavy mango crops. In both these districts the rain falls during the early months of the year and the months between July and November are practically dry. This dry season coincides with the main flowering and early fruit growth, and regular cropping and good quality fruit result.

At Innisfail, annual rainfall is approximately 140 inches. Although the greater part of this precipitation is experienced during the first half of the year, a considerable number of showery days occurs during the later months. Under these conditions tree growth is vigorous but flowering is irregular and the incidence of disease on the flowers and fruit is high.

At Townsville, with approximately the same rainfall as Bowen, a variation in mango cropping is introduced. Throughout North Queensland there is a regular early flowering which precedes the main flowering by two to three months. In many parts this flowering is destroyed by fungus infection, following rain or heavy dews, but at Townsville neither rainfall nor dew occurs at this time so an early fruit setting is obtained in addition to the normal crop.

Dry weather during flowering and early fruit growth are of the utmost importance.

SOIL REQUIREMENTS.

The mango is extremely adaptable in the matter of soil. In Queensland it may be found thriving on soils derived from decomposed granite, basalt and schists, and on alluvials and beach sands. Good drainage is the most important feature and it should be coupled with a stable water table. The depth of the water table is not of vital importance provided it does not fluctuate between wide limits in any location and provided it is not in the surface soil range. The tree forages widely and deeply where the soil is of suitable texture and well drained, and it is this habit that makes it so adaptable.

[TO BE CONTINUED.] p. 146

PLANT PROTECTION

Banana Rust Thrips Control Experiment, 1948.

J. HAROLD SMITH, Assistant Director of Horticulture,*
and J. A. WEDDELL, Entomologist, Science Branch.

IN 1946-47, an experiment at Beenleigh demonstrated that, in a moderate outbreak of the banana rust thrips†, the pest could be controlled by applying a 2 per cent. DDT dust to the bunches at fortnightly intervals during the growing period. The work also indicated that bunch protection for a period of eight weeks would be adequate in commercial practice.

More recent work carried out in the 1947-48 season was both demonstrational and experimental in character. It was intended to demonstrate the benefits to be derived from using 2 per cent. DDT dust and at the same time to compare other methods of treatment. The plots were located in plantations at four different centres and the insecticidal treatments were applied mainly by field officers of the Horticulture Branch without whose assistance the project could not have been carried through.

Experimental Plan and Method.

Three different insecticides were compared and some bunches were left untreated to serve as checks. The treatments referred to were as follows:—

2 per cent. DDT dust;

4 per cent. BHC dust;

1 per cent. DDT and 1·5 per cent. BHC combined dust.

The insecticides were applied first when the bunch was thrown and thereafter at fortnightly intervals for a period of six weeks. Each bunch that was thrown in a plot requiring treatment with an insecticide thus received four applications. Thereafter it was given no further attention until it was approaching commercial maturity, when the final assessment of rust incidence was made. The plots were established during the first week of January, 1948, and all bunches thrown between that time and the end of March received the appropriate applications.

The experiment was divided into eight replicates and in each replicate approximately 50 bunches were treated with each insecticide, a similar number being left untreated. Two of these replicates were

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† *Scirtothrips signipennis* Bagn.

placed at each of four centres—Golden Valley (via West Burleigh), Beenleigh, Palmwoods and Gympie. Thus the total experiment involved approximately 1,600 stools of bananas. The conditions at each centre were as follows:—

Golden Valley.—First-cut Cavendish and Mons Marie bananas, on a north-westerly slope. Thrips moderately active in January.

Beenleigh.—First-cut Mons Marie bananas on a north-easterly slope. Thrips moderately active in January.

Palmwoods.—First cut Cavendish bananas on a northerly slope. Thrips fairly light in January, developing rapidly in intensity.

Gympie.—First-cut and second-cut bananas of mixed varieties, viz., Cavendish, Mons Marie and Sugar, on a north-westerly slope.

Generally speaking, throughout the experimental areas the banana rust thrips was the only fruit pest of any consequence. Some damage due to fruit-eating caterpillars* was found and although this was of minor importance observations on the effects of the insecticides on these insects were nevertheless possible.

In addition, at the Golden Valley and Beenleigh plantations a number of bunches outside the experimental plots were covered with hessian when thrown and were given two applications of 2 per cent. DDT dust, the first immediately prior to covering and the second a fortnight later under the covers.

Method of Assessing Results.

As in previously conducted banana rust thrips control experiments the method of assessing results was by allotting values or ratings to the fruit as it approached maturity, the value 0 being given to unblemished fruit and the value 3 being given to fruit showing maximum injury. On this occasion the experiment was distributed in four widely spaced districts. Hence a common standard for maximum injury rating could not be adopted and the standard in each centre was the condition of the worst top hand present in the plots that received no treatment. By this means the relative values of the different treatments could be fairly assessed. So as to prevent the possibility of fruit reaching maturity and having to be harvested by the growers in the absence of the experimenters, it was decided that the assessments would take place at standard times after the inception of the work, depending on the time the bunches were thrown, according to the following table:—

Bunches thrown.	Injury assessed.
During first 4 weeks ..	12 weeks after inception
During 5th to 8th week ..	16 weeks after inception
During 9th to 12th week ..	20 weeks after inception

* *Heliothis armigera* Hb. (mainly).

Results.

Of the insecticides used, the 4 per cent. BHC dust gave consistently the best results in banana thrips control although the other two—that is, the 2 per cent. DDT dust, and the 1 per cent. DDT and 1·5 per cent. BHC combined dust—were nevertheless quite satisfactory. Earlier mention was made of the presence of some fruit-eating caterpillars. The principal species in this instance was the corn ear worm; an Oecophorid was also present but it occurred in the bracts and was not injurious to the fruit. The former species caused some damage to bunches in the plots treated with BHC and in the untreated plots. In the plots which received DDT, either alone or in combination with BHC, fruit injury from that cause was absent.

The superiority of BHC over DDT from the point of view of thrips control is doubtless due to its fumigant properties which may contribute something to the more effective eradication of the insects from the relatively protected top hands, a matter that is discussed later. For the time being, however, DDT is still the obvious choice, for it has not the objectionable smell of BHC, and while giving good thrips control it is effective against fruit-eating caterpillars.

Discussion.

1. *Effect of location on rust incidence.*—In the season under discussion the heaviest rust occurred in the Palmwoods plantation, which has a northerly slope. The attack was moderately severe during the three-month period from January to March. At Beenleigh and Gympie the outbreak reached its peak in February and tapered off rather sharply during the following month.

2. *Effect of variety on rust incidence.*—The fruits of the Cavendish variety are tightly pressed together when the bunches are thrown. In Mons Marie, the fruits are initially well spaced and close up two or three weeks later. Equal thrips populations would therefore be expected to cause more damage to the variety Cavendish than to Mons Marie, as the insect prefers the shelter provided by closely packed fruit. This feature was noticed where untreated bunches of each variety were compared. Again, as the upper hand is the most difficult on which to apply an insecticide, contains the best fruit, and is the most susceptible to rust, Mons Marie would appear to be the better variety to grow in areas susceptible to rust. Mons Marie is, however, a tall variety and proper treatment is far from easy. Thorough coverage with the insecticide is essential when thrips are active, and the accessibility of bunches in the dwarf types of Cavendish may offset the apparent advantages of the taller Mons Marie.

3. *The operator and control efficiency.*—Each plantation was serviced by a different operator and there were inevitable differences in the dusting technique. It was noticeable that to some extent these differences were reflected in the final results, without at the same time affecting the validity of comparisons between treatments. It was, however, demonstrated that the dust application, though light, should be thorough and even.

4. *Rust incidence and plant age.*—It is normally considered that the "plant" crop is most susceptible to rust. The data from Gympie suggest that, under some circumstances, second-cut bunches are as susceptible to attack by thrips as first-cut bunches. Insecticidal control

may, in addition, be more difficult in second-cut bunches owing to (*a*) the greater difficulty of treatment (unless a one-bunch one-sucker programme is used), and (*b*) the increasing proportion of compacted top hands in all but well-managed plantations growing in fertile soil.

5. *The role of bunch covers.*—Thrips control recommendations prior to the advent of DDT required the use of a nicotine dust under hessian covers. More recently covers have been used to a greater extent in order to improve fruit quality, irrespective of possible thrips infestation, particularly in bunches thrown from March onwards. Covers, however, may have some value in summer in promoting an even filling of the fruit in all parts of the bunch.

The results obtained from the use of DDT under bunch covers in the subsidiary treatment mentioned earlier were quite good so far as thrips control is concerned, though somewhat inferior to uncovered bunches receiving the normal insecticidal treatment. This may be a disability inherent in the use of a dust, such as DDT, with a non-fumigant effect, when applied under covers. Little dust can be expected to reach the upper hands where it is most needed. Dust containing BHC would probably be more effective under such conditions.

In view of the known effectiveness of DDT and BHC when used without covers, the summer use of covers should be recommended only because of their possible contribution to fruit quality. If covers are to be used and thrips control measures are also needed, then the two can be combined satisfactorily. A suitable method would be to delay the placing of the covers until after the second application of the insecticide.

Conclusions.

1. A 2 per cent. DDT dust, a 4 per cent. BHC dust and a dust containing 1 per cent. DDT and 1·5 per cent. BHC all gave good control of the banana rust thrips in moderately severe outbreaks at Golden Valley (via West Burleigh), Beenleigh, Palmwoods and Gympie when applied four times at fortnightly intervals from the time the bunch was thrown.

2. The 4 per cent. BHC dust was rather more effective than the 2 per cent. DDT dust against banana rust thrips, particularly when it was difficult to get complete coverage, as for instance in the top hands shortly after the bunch was thrown. The insecticide is, however, objectionable to use.

3. DDT is a general purpose dust which controls both banana rust thrips and certain fruit-eating caterpillars. BHC may allow fruit-eating caterpillars to develop normally.

4. Thorough bunch treatment is essential when insecticides are used to control banana rust thrips. Particular care needs to be taken in the case of the less accessible bunches of the taller varieties.

Estimation of Acidity in Milk, Cream and Whey.

Prepared in the Division of Dairying.

THE regulations under the Dairy Produce Acts specify that no milk containing more than 0·25 per cent. nor cream containing more than 0·67 per cent. of acidity shall be classified as first-grade quality. The development of acidity in milk and whey is all-important in cheesemaking and accurate control of cream acidity plays a very large part in the manufacture of a good quality butter.

For these reasons it is essential that accurate acidity tests be performed at all times. Attention to details and a knowledge of the principles involved in the estimation are as necessary to the factory operative as they are to the analyst.

Reagents.

1. *Decinormal sodium hydroxide,* also known as tenth normal or N/10 alkali.

2. *Phenolphthalein* indicator solution.

Apparatus.

1. *Burette,* graduated in 0·1 ml. divisions.

2. *Burette stand* and *clamp.*

3. *Pipette,* may be of any desired capacity. Usually a 9 ml., 10 ml., 17·6 ml., or 20 ml. pipette is used.

4. *Titration vessel.*

5. *Glass stirring rod.*

Determination.

(a) *Milk and Whey.*—By means of the pipette measure out a known volume of milk or whey, wiping the outside of the pipette *before* adjusting the bottom of the meniscus to the graduation mark.

Transfer to the titration vessel. Add 5 to 10 drops of phenolphthalein solution. From the burette run in the decinormal sodium hydroxide solution drop by drop, stirring the contents of the vessel constantly. Stop when the first tinge of pink colour appears. Read off the volume of decinormal alkali solution used.

$$\text{Percentage of acidity} = \frac{\text{ml. of N/10 alkali used} \times 0{\cdot}009 \times 100}{\text{quantity of sample taken.}}$$

(b) *Cream.*—By means of the pipette measure a known volume of cream, wiping the outside of the pipette *before* adjusting the bottom of the meniscus to the graduation mark.

Transfer to the titration vessel. Rinse out the pipette with warm distilled or rain water by filling approximately to the position of the graduation mark and add the rinsings to the contents of the titration vessel. Add five to ten drops of phenolphthalein solution and proceed as directed for milk and whey.

Acidity.

When milk is freshly drawn from the udder it has an acidity ranging from 0·1 to 0·2 per cent., in some cases even higher, the average being about 0·17 per cent.

This initial acidity is due to acid salts, casein, and dissolved carbon dioxide. On exposure to the air some of the carbon dioxide escapes and the acidity drops a little. It soon begins to rise again owing to the action of bacteria which act upon the lactose, forming lactic acid. There are thus two forms of acidity in milk, the initial acidity due to normal milk constituents and that due to lactic acid.

As it is difficult to differentiate between the lactic acid and other acidity, the whole acidity is for convenience calculated and reported as percentage of lactic acid.

Principle of the Test.

When an acid is mixed with an alkali a chemical reaction occurs with the formation of a neutral substance, termed a salt, and water. This reaction is known as neutralization. Thus when lactic acid and sodium hydroxide react, neutralization occurs with the formation of sodium lactate and water.

$$\underset{\text{Lactic acid}}{C_3H_6O_3} + \underset{\text{Sodium hydroxide}}{NaOH} \longrightarrow \underset{\text{Sodium lactate}}{C_3H_5O_3\,Na} + \underset{\text{Water}}{H_2O}.$$

As this is a reaction between definite chemical compounds, it is a comparatively simple matter to estimate the percentage of lactic acid when a known amount of milk or cream is initially taken and neutralized with a sodium hydroxide solution of known strength. The neutralization must not be overdone, however, and a substance known as an indicator is used to show when the neutralization is complete. Indicators are substances which display a marked colour change in acid and alkaline solutions. Phenolphthalein, for example, is colourless when acid and red when alkaline, and has been found to be the most suitable indicator for the particular purpose under discussion.

Calculation of Percentage.

From the equation shown above it has been calculated that 90 parts by weight of lactic acid will be neutralized by 40 parts by weight of sodium hydroxide. The decinormal sodium hydroxide is made to a

definite strength and contains 4 grams per litre. Thus 1 ml. (one thousandth of a litre) contains 0·004 gram of sodium hydroxide. It is just a matter of simple proportion to determine that 1 ml. of decinormal sodium hydroxide solution will neutralize 0·009 gram of lactic acid.

When a known quantity of milk or cream is taken and the acidity is neutralised by a determined volume of decinormal sodium hydroxide, the percentage of acidity may thus be determined:—

$$\text{Acidity percentage} = \frac{\text{ml. of N/10 alkali used x 0·009 x 100}}{\text{quantity of milk or cream used}}$$

This equation may be used when any known quantity of milk or cream is taken. Applying it to the widely used 9 ml. pipette the equation becomes

$$\text{*Acidity percentage} = \frac{\text{ml. of N/10 alkali used x 0·009 x 100}}{9}$$

$$= \frac{\text{ml. of N/10 alkali used}}{10}$$

When any other volume of milk or cream is taken the full equation must be used.

Precautions to be Observed.

1. *The sample taken for examination must be representative of the bulk.*—This is so obvious that a detailed discussion is unnecessary. Care must therefore be taken to mix thoroughly the contents of the vat or other container, and then to take a number of small samples from different places, and thoroughly mix these small samples together.

2. *Location of Equipment.*—The tests should be performed in a well lighted position but not in direct sunlight. It should, of course, be close to the neutralizing vats in a butter factory and to the cheese vats in a cheese factory. It has sometimes been noticed that the equipment is placed in a small cupboard or dark corner of a factory where accurate tests are impossible. It is such an essential part of factory routine that provision should be made for this equipment when the factory is being designed.

3. *Accuracy of the Graduated Glassware.*—Of those pipettes likely to be used in acidity tests, specifications are provided in the Dairy Produce Acts for the usual 9 ml. pipettes and for the 17·6 ml. pipettes which can also be used. Although alternative sizes can be used, the operator is advised to use one of these two if at all practicable. These two pipettes are required to be certified as to their accuracy, and none other than those officially stamped by the Department of Agriculture and Stock should be used.

Pipettes of other capacities and also burettes do not need to conform to Departmental specifications, and the best precaution here is to purchase from only reputable firms.

4. *The Titration Vessel.*—The ideal titration vessel is a shallow white cup or basin with translucent walls. This is hardly necessary for ordinary work, for which a shallow wide-mouthed cup will be found

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* Strictly speaking this only gives the percentage by volume, i.e., 100 volumes of milk or cream contain so many parts by weight of lactic acid. The figure so obtained is, however, close enough for most practical purposes.

satisfactory. A metal vessel, such as is used in butter factories for collecting cream samples, is very unsatisfactory and should never be used.

5. *The water added when testing cream.*—The water used to rinse out the pipette when cream is being tested should be neutral in reaction—i.e., it should be perfectly colourless when phenolphthalein is added to it, yet should turn pink when one drop of N/10 alkali is added to 9 ml. of water. There are a number of factories using bore or well waters which contain considerable quantities of sodium carbonate in solution. Such waters are alkaline and will neutralize at least a portion of the acidity. One case has been noticed where 9 ml. of water were responsible for neutralising 0·009 per cent. of acidity when 9 ml. of cream were used. The acidity tests in that particular factory would therefore be about 0·09 per cent. lower than the true percentage. In another case the water was distinctly acid, due to a clarification process, and tests using this water were higher than the true percentage. Water for the acidity test should not be taken from the hot water vessel used for the Babcock Test as this may be distinctly acid. A vessel recently washed with an alkaline cleanser may be responsible for considerable alkali being added with the water. If possible, distilled water (condensed steam) or rain water should be used.

6. *Accuracy of the decinormal sodium hydroxide.*—Most factories purchase their supply of decinormal sodium hydroxide solution from supply houses.

If kept in stock for too long a period a flaky sediment is formed by the action of the alkali on the glass. This may be very largely prevented by manufacturers coating the inside of the bottles with hard paraffin wax which is unaffected by alkali.

As usually prepared, the required weight of sodium hydroxide is weighed out and dissolved in the required volume of water, and the solution is then tested and corrected. This is somewhat unsatisfactory, as even the purest sodium hydroxide may contain up to 2 per cent. of sodium carbonate. This has the effect of causing the pink colour to appear and then fade rapidly although the total alkalinity may be correctly decinormal. A more satisfactory method of preparation is described later.

If the alkali solution is exposed to the air for any length of time, either by removing the stopper or allowing to stand in the burette, carbon dioxide is absorbed from the air, forming sodium carbonate. Care should therefore be taken to keep the stock bottle well corked and discard the alkali remaining in the burette after the final titration for the day.

7. *Depth of pink colour.*—The depth of colour developed during the titration has been noticed to vary considerably, depending apparently on the person performing the test. This may be due to inability on the part of the operator to detect the first tinge of pink, an insufficiency of phenolphthalein solution, carelessness, or ignorance of what is required. Some firms supply glass stirring rods in which are enclosed pink paper and the titration is supposed to proceed until the pink colour in the milk or cream matches that of the paper. This is not always successful as some milks and creams normally have a rich yellow colour and the

first change of colour noticeable is more orange than pink. Probably the most satisfactory method is to have a second cup in which is placed 9 ml. of the particular milk being tested, or 9 ml. of the particular cream and 9 ml. of water, alongside the operator. By comparison the first change of colour is easily noticed.

As the pink colour only develops slowly it is necessary to have sufficient phenolphthalein present to give a distinct pink with one or two drops of excess alkali. At least 5 drops of a 1 per cent. phenolphthalein solution should be added and the same quantity should be used for each test.

8. *Effect of carbon dioxide.*—Carbon dioxide, which is also known as carbonic acid gas, seriously affects the acidity test.

When carbon dioxide is present it combines with the sodium hydroxide and forms sodium bicarbonate and sodium carbonate. As the former compound decolourises phenolphthalein, erroneous results are obtained. When fermented or gassy creams are being tested the error may be 0·07 per cent. or even higher.

After cream is neutralized it is passed over the pasteuriser and the heating to which it is subjected liberates most of the carbon dioxide. If pasteurisation is followed by, or is simultaneous with, a vacuum treatment, it is probable that all carbon dioxide is liberated. It is because pasteurised cream thus contains less carbon dioxide than raw cream that the acidity following pasteurisation is generally lower than that desired. If very accurate acidity tests are desired for cream, the 9 ml. of cream and rinsings should be gently boiled for about 30 seconds. Having thus liberated the carbon dioxide the cream should be cooled and titrated as usual.

9. *Care of equipment.*—All equipment used in performing acidity tests should be thoroughly cleaned at the end of each day's work. After all milk, cream or other residues have been thoroughly removed, the pipettes and titration vessels should be rinsed several times with distilled (or rain) water. Pipettes should be allowed to drain by suspending vertically in a wooden rack and titration vessels can be dried with a clean cloth.

Particular attention is necessary in the care of a burette, especially if it is a glass-stoppered type. A solution of sodium hydroxide will quickly render the stopper immovable and daily washing out of the burette with the stopper removed is recommended. Before starting titrations the next day the stopper should be very lightly greased if it appears dry, and the burette should be rinsed out with a little of the titrating solution, which is then discarded.

Burettes having a short piece of well-fitting rubber tubing inserted between the base of the burette and the final glass tip are very suitable for acidity titrations. A small glass bead constricts the tubing and prevents the solution from running out. By pinching the tube, however, the liquid can pass around the bead and the titration can be easily accomplished. This type should also be washed out after the final use each day. Its great advantage is the elimination of cemented stoppers and the ease with which a replacement can be made at any time.

Preparation of Decinormal Sodium Hydroxide.

For those factories which have the services of a chemist available, the following method of preparation is strongly recommended. Dissolve one pound of the purest sodium hydroxide obtainable, preferably of "AnalaR" or "Guaranteed Reagent" quality, in one pound (450 ml.) of distilled water. This solution is to be allowed to stand for some days in a resistance glass vessel, or in a bottle internally coated with hard paraffin wax, securely stoppered with a rubber cork or waxed bark cork. After a few days the sodium carbonate, which is practically insoluble in such a strong solution of sodium hydroxide, will have settled to the bottom, leaving the supernatant liquid clear. This clear liquor, which contains about 50 per cent. by weight of caustic soda, has a specific gravity of about 1·53, and can be siphoned off into another similar container for storage purposes. This solution is of such strength that only from 5·5 to 6 ml. are required for each litre of decinormal solution required.

When diluting this strong solution preparatory to standardising, the distilled water should be boiled and cooled just prior to use. This is to free it from carbon dioxide which it absorbs from the air. Rain water may be used, but other waters are unsuitable. The diluted solution should be made slightly stronger than decinormal, as it is far easier to dilute the solution than to add a small amount of strong alkali during the subsequent adjustment.

A known volume of a standard acid solution (N/10 or N/5) is pipetted into a titration flask, one or two drops of phenolphthalein solution added, and then titrated with the approximately N/10 alkali until the pink colour remains for 20-30 seconds. (It will eventually disappear by the solution absorbing carbon dioxide from the air.) The required volume of water to be added may then be calculated as follows:—

Twenty ml. of standard N/10 acid (or 10 ml. of standard N/5 acid) required 19·1 ml. of the approximately N/10 alkali solution. If the alkali were accurately N/10 it would have required 20 ml. exactly. Say that there is 9,900 ml. of alkali solution left after the initial test. The amount of water to be added is then—

$$\frac{(20{\cdot}0 - 19{\cdot}1) \times 9{,}900}{19{\cdot}1} = \frac{0{\cdot}9 \times 9{,}900}{19{\cdot}1} = 466 \text{ ml.}$$

As a precautionary measure only 450 ml. of water should be added and the solution tested as before. When the solution is accurately adjusted at least two titrations should be made to confirm the standardization.

The solution should then be stored in tightly-corked resistance glass bottles or waxed bottles, labelled with the date and the name of the person who performed the standardization.

Preparation of Phenolphthalein Solution.

The indicator solution is prepared by dissolving 1 gram of phenolphthalein powder in 100 ml. of 90 per cent. alcohol. The alcohol need not be that known as rectified spirit, methylated alcohol or denatured alcohol being quite satisfactory. Methylated spirits, however, should not be used for the purpose.

PRODUCTION RECORDING.

List of cows and heifers officially tested by Officers of the Department of Agriculture and Stock, which qualified for entry into the advanced register of the A.I.S., Jersey, Guernsey and Ayrshire Societies' Herd Books, production records for which have been compiled during the months of October, November and December, 1948 (273 days unless otherwise stated).

Animal.	Owner.	Milk Production.	Butter Fat.	Sire.	Month Compiled.
		Lb.	Lb.		
AUSTRALIAN ILLAWARRA SHORTHORN.					
MATURE COW (STANDARD 350 LB.).					
Treviac Rosella	W. A. Freeman, Rosewood	9,455·45	416 75	Trevlac Premium	October
Pilton View Sadie 3rd	F. Derrick, Moonford	9,787·25	396·405	Sunnyview Myrtle's Renown	October
Yarranvale Merrymaid	W. D. Davis, Wambo	8,694 0	372·913	Trevor Hill Bosca	November
Lynfield Pearl	F. Birt, Sexton	10,043 95	356 137	Parkview Ransom	November
Trevor Hill Primrose 6th	Madge Bros., Southbrook	12,223 65	537·186	Alfa Vale Reflex	December
Navillus Show Girl 4th	C. O'Sullivan, Greenmount	15,115·7	501·086	Greyleigh Eros	December
Fernhome Emily	R. S. Griffiths, Moregatta	8,452·65	428 783	Glengarry Gem's Royal	December
Rhodesview Fanny 49th	W. Gierke, Helidon	10,048·6	408·522	Fairvale Major	December
Fernhome Hannah	R. S. Griffiths, Moregatta	7,558·2	387·385	Rosenthal Compensation	December
Fernhome Jessie	R. S. Griffiths, Moregatta	8,053·65	370·347	Glengarry Gem's Royal	December
SENIOR, 4 YEARS (STANDARD 330 LB.).					
Tara Plumber's Flower (365 days)	C. K. Roche, Wheatvale	12,007·1	505 843	Alfa Vale Plumber	October
Valera Nancy 2nd	D. Sullivan, Bantry, Pittsworth	10,475 0	430 48	Alfa Vale Pride 2nd	November
SENIOR, 3 YEARS (STANDARD 290 LB.).					
Rhodesview Butterfly 5th	Gierke and Sons, Helidon	7,849 3	339·351	Alfa Vale Nigel	October
Bantry Model	D. Sullivan, Pittsworth	9,239·05	398 365	Alfa Vale Pride 2nd	November
Navillus Shannon 11th	C. O'Sullivan, Greenmount	11,687·95	494·084	Greyleigh Eros	December
JUNIOR, 3 YEARS (STANDARD 270 LB.).					
Dorravista Fussy 3rd	H. A. Turner, Tarzali	12,320 4	521·181	Byron of Glencoe	October
Rhodesview Nancy 69th	W. Gierke and Sons, Helidon	7,579·0	331·454	Alfa Vale Nigel	December
SENIOR, 2 YEARS (STANDARD 250 LB.).					
Derradale Countess	F. Derrick, Moonford	8,791·25	361·046	Applegarth Maxwell	October
Boah Peak Primrose 3rd	H. L. and C. I. Bruggemann, Kulpi	6,509·5	254·29	Fairvale Musketeer	October
Ronnoc Lady May 9th	O'Connor Bros., Colinton	11,813·95	490·128	Ronnoc Emblem	November
Rhodesview Daisy 3rd	W. Gierke and Sons, Helidon	7,623·4	294·898	Alfa Vale Nigel	November
Navillus Countess 5th	C. O'Sullivan, Greenmount	12,960·75	455·722	Parkview Limerick	December
Fernhome Rosette	R. S. Griffiths, Moregatta	7,601·4	322·775	Glengarry Gem's Royal	December
Navillus Gem 2nd	C. O'Sullivan, Greenmount	8,154 35	310·641	Parkview Limerick	December
Fermanagh Roseleaf 5th	F. B. Sullivan, Pittsworth	6,188·14	283·035	Alfa Vale Pride 2nd	December
Navillus Charm 20th	C. O'Sullivan, Greenmount	6,959·95	268·476	Parkview Limerick	December
Fermanagh Sheila 3rd	F. B. Sullivan, Pittsworth	5,573·3	264 16	Valera Roseleaf's Pride	December
Springleigh Primrose 21st (242 days)	H. T. Moller, Boonah	6,727·75	252 993	Blacklands Melba's Pride	December

		Junior, 2 Years (Standard 230 Lb.).			
Dorravista Fairy 15th	H. A. Turner, Tarzali	11,434·5	526 48	Byron of Glencoe	October
Alfa Vale Model 30th (365 days)	W. H. Thompson, Nanango	10,903·35	484·029	Alfa Vale Paisley	October
Murcott Clara 3rd	T. McLennan, Willowvale	7,355·05	286·299	Rozanna Red Radiance	October
Rosenthal Lilac 22nd	Mitchell and Mulcahy, Warwick	6,571 2	277·447	Corunna Potentate	October
Millievale Olive (249 days)	A. H. Webster, Stockyard Creek	7,112·9	275·722	Woodville Viscount	October
St. Andrews Violet	M. C. Lester, Glengallon	5,540 05	258 025	Bingleigh Premier	October
Murcott Laurel II	T. McLennan, Willowvale	6,401·2	255·386	Murcott General	October
Roshill Stella Girl	W. Flesser, Boyland	7,084·15	253·044	Dnalwon Felix	October
Rosenthal Choice 22nd	Mitchell and Mulcahy, Warwick	6,085·95	238·317	Corunna Potentate	October
Fairlie Bud 25th	Mitchell and Mulcahy, Warwick	5,907 75	236·694	Rosenthal Lilac 4th Emblem	October
Alascan Bess	A. Lohse, Biggenden	6,960 5	297·23	Sunnyview Ruby's Elect	November
Bunya View Dora	K. Berghofer, Athol	5,698·96	257·622	Trevor Hill Progress	November
Bunya View Rosette 5th	W. D. Davis, Wambo	5,856 6	240·903	Trevor Hill Progress	November
Alascan Red Rose 2nd	A. Lohse, Biggenden	7,005·35	232·496	Sunnyview Ruby's Elect	November
Valera Bonny 14th	Sullivan Bros , Pittsworth	8,082·3	397·387	Alfa Vale Pride 2nd	December
Faimoye Plum 2nd	C. K. Roche, Warwick	6,058 5	248·307	Sunbridge Expert	December
Bunya View Rosemary	Edward Bros., Kingaroy	5,657 25	245 221	Trevor Hill Progress	December
Aynsley Gwen 10th	V. R. Nugent, Murgon	6,648·45	239·871	Alfa Vale Pride 6th	December
Applegarth Colleen 5th	R. A. and N. K. Shelton, Hivesville	6,425 0	236 471	Fairholm Monty	December
		JERSEY.			
		Mature Cow (Standard 350 Lb.)			
Inverlaw Patricia	R. J. Crawford and Sons, Kingaroy	6,699 5	408·679	Inverlaw Saturn	October
Brooklands Primrose	W. S. Conochie, Sherwood	7,313·35	395·753	Brooklands Padishah	October
Oxford Spotted Morel	V. Granger, Nerang	7,315·4	385·461	Oxford Peer	October
Kinross Lana	R. J. Bott, Tiaro	7,943·5	367·734	Glenview Royal Diamond	October
Kathleigh Vanity	F. W. Kath, Moffatt	8,760 41	450 9	Kathleigh Jersey King II	November
Glenrandle Nisa 2nd	M. J. Kerlin, Killarney	8,072 7	440 008	Bellgarth Stylish	November
Boree Tinklebelle	W. and C. E Tudor, Gayndah	8,460 38	413 802	Maurfield Larkspur's Gift	November
Romsey Brown May	J. Wilton, Killarney	7,939·6	413 284	Oxford Dainty Peer	November
Romsey Flower	J. Wilton, Killarney	7,201 1	363·260	Oxford Dainty Peer	November
Tecoma Golden Darling	A. Semgreen, Coolabunia	5,796·6	358·837	Trinity Golden Royal	December
		Senior, 4 Years (Standard 330 Lb.)			
Nairfale Princess Beth (365 days)	R. J. Browne, Yangan	8,706 8	434 692	Nairfale Noble Count	November
Nairfale Noble's Rosemary	R. J. Browne, Yangan	8,698·9	404 382	Nairfale Pride's Noble	November
Bellgarth Fairy 4th	D. R. Hutton, Cunningham	7,114 55	381·056	Trecarne Victor 2nd	November
		Junior, 4 Years (Standard 310 Lb.).			
Glenrandle Larkspur	P. Kerlin, Killarney	8,912·4	483·856	Bellgarth Glory King	October
Kathleigh Carmel	F. W. Kath, Moffatt	8,376·57	456·008	Trecarne Quality Lad	October
Pinegrove Betty	J. W. Evans, Tallegalla	5,429 35	317·616	Glenview Victor	October
Brookland Merry Melrose	H. T. W. Barker, Oakey	6,556·15	387·164	Bulby Maria's Keepsake	November
Kinross Dorothy 2nd	H. R. Randall, Woowoonga	7,944 0	330·516	Kinross Jester	November
Kathleigh Flicka	F. W. Kath, Moffatt	7,578 69	395·085	Oxford Daffodil's Victor	December
Gunawah Marguerite	R. D. Johnson, Kingaroy	7,710 85	356·385	Gunnawah Jack Frost	December
		Senior, 3 Years (Standard 290 Lb.).			
Gem Ishma	W. Bishop, Kenmore	8,379 4	397·331	Bulby Oxford Gamboge	October
Nairfale Neat Neta	R. J. Browne, Yangan	6,802 8	351·654	Nairfale Counts Paymaster	October
lenrandle Spotted Lady	P. Kerlin, Killarney	5,412·0	311·220	Oxford Noble Peer	October
m Dolores	W. Bishop, Kenmore	9,503·3	445·762	Bulby Oxford Gamboge	December

PRODUCTION RECORDING—*continued.*

Animal.	Owner.	Milk Production.	Butter Fat.	Sire.	Month Compiled.
		Lb.	Lb.		
	JERSEY—*continued.*				
	JUNIOR, 3 YEARS (STANDARD 270 LB.).				
Kathleigh Bonnie	F. W. Kath, Moffatt	7,853·56	408·606	Oxford Daffodil's Victor	October
Trinity Bright Lass	J. McCarthy, Budgee	7,453·8	379·783	Trinity Crowning Effort	October
Westbrook Sylvia 23rd	Farm Home for Boys, Westbrook	6,162·55	296·057	Selsey Royal Standard	October
Windsor Lady Alice	H. W. Barker, Oakey	5,321·25	270·829	Brookland Sultan's Victory	October
Gem Claudia	W. Bishop, Kenmore	9,155·85	416·373	Gem Valour	November
Gem Violet	R. W. Webb, Stafford	5,783·1	356·318	Englorie Cunning Victor	November
Palen Lady Optician	Prison Farm, Palen Creek	6,346·45	326·713	Palen Optician	November
Trinity National Wedding	J. S. McCarthy, Greenmount	5,860·3	287·537	Trinity National Victory	November
Ashview Locket 3rd	C. Huey, Sabine	7,375·1	388·66	Trecarne Victor 4th	December
Kathleigh Brown Maid	F. W. Kath, Moffatt	6,443·25	370·611	Kathleigh Silveen's Victory	December
Ashview Queen 2nd	C. Huey, Sabine	6,536·0	341·595	Trecarne Victor 4th	December
Tecoma Melody	A. Semgreen, Coolabunia	4,888·1	285·198	Trinity Golden Royal	December
	SENIOR, 2 YEARS (STANDARD 250 LB.).				
Gem Magna	W. Bishop, Kenmore	8,064·0	435·567	Bulby Oxford Gamboge	October
Upwell Miss Binstead	B. T. Seymour, Kapaldo	5,996·5	313·984	Glenview Some Sultan	October
Lynbell Milkmaid	C. S. Coleman, Beaudesert	5,523·8	294·973	Hocknell Ginger Star	November
Bonathorne Fashion's Pride	D. R. Hutton, Cunningham	5,151·55	270·041	Woodside Winston	November
Silverbrook Brighteyes	J. Schull, Oakey	4,588·45	263·115	Lermont Ambassador 2nd	November
Burnlea Mischief	R. O. M. Unkles, Didcot	5,104·55	256·426	Burnlea Aviator 4th	November
Kathleigh Silver 3rd	C. W. and E. M. Barlow, Boodua	6,076·05	359·555	Oxford Fawn's Noble	December
Kathleigh Letren 2nd	C. W. and E. M. Barlow, Boodua	5,434·0	336·465	Oxford Fawn's Noble	December
	JUNIOR, 2 YEARS (STANDARD 230 LB.).				
Mayfair Golden Slipper IV.	J. W. Carpenter, Helidon	4,560·55	294·718	Lermont Double Volunteer	October
Woodview Jersey Queen	P. H. Schull, Oakey	4,686·85	283·296	Woodview Some Victory II.	October
St. Joseph's Hazel 3rd	P. J. Bygrave, Aspley	5,198·75	259·404	St. Joseph's High Design	October
College Mistletoe 2nd	Queensland Agricultural High School and College, Lawes	4,803·4	253·618	Westbrook Ambassador 52nd	October
Myrtledale Sea Green	C. J. McKell, Jaggan	3,601·8	250·013	Myrtledale Northern Star	October
Nairfale Comedy's Design	R. J. Brown, Yangan	4,523·3	244 418	Kelvinside Handsome Boy	October
Ashview Queen 3rd	C. Huey, Oakey	4,704·75	237·973	Trecarne Victor 4th	October
Bellgarth Royal Lady	D. R. Hutton, Cunningham	6,500·9	348·707	Romsey Spotted King	November
Woodview Lillian	P. H. Schull, Oakey	5,603·5	345·846	Woodview Officer	November
Kathleigh Brownie	F. W. Kath, Moffatt	6,306·31	314·95	Oxford Fawn's Noble	November
Upwell Gay Guest	E. W. Goody, Bancroft	5,799·75	307·440	Glenview Some Sultan	November
Glenrandle Chimes	P. Kerlin, Killarney	6,065·2	294·826	Bellgarth Glory King 2nd	November
Oxford Thoreen	Queensland Agricultural High School and College, Lawes	5,282·15	291·677	Glenside Golden Victory	November
Kathleigh Sylkyle	F. W. Kath, Moffatt	5,422·07	282·737	Oxford Fawn's Noble	November

Glenrandle Fashion 2nd	P. Kerlin, Killarney	5,588·0	276·252	Waltham Farm Brown Boy	November
Glenrandle Brown Maid	P. Kerlin, Killarney	5,781·4	272 860	Waltham Farm Brown Boy	November
Romsey Brown Model	J. Wilton, Killarney	4,509 2	244 925	Bellgarth Ruler 4th	November
Nairfale Chenille	R. J. Browne, Yangan	4,924·5	238 262	Kelvinside Handsome Boy	November
Kathleigh Singer	F. W. Kath, Moffatt	6,125·42	344·728	Oxford Fawn's Noble	December
Kathleigh Valencia	F. W. Kath, Moffatt	6,909·69	344·245	Oxford Fawn's Noble	December
Upwell Funny Fawn	E. W. Goody, Bancroft	6,346·25	330·497	Kenview Some Sultan	December
Kathleigh Patricia 4th	C. W. and E. M. Barlow, Boodua	5,360 6	325 635	Oxford Fawn's Noble	December
Weelu Lucky Effort	C. W. and E. M. Barlow, Boodua	5,409·05	324·434	Trinity Lily's Effort	December
Kathleigh Laurette	F. W. Kath, Moffatt	5,953·56	323 921	Oxford Fawn's Noble	December
Lermont Tinklebell 2nd	J. Schull, Oakey	6,017·55	320·566	Trinity Graceful Duke	December
Kathleigh Spotted Peerless	F. W. Kath, Moffatt	6,352 53	317 915	Oxford Fawn's Noble	December
Kenilworth Nellie	J. L. Evans, Cooroy	5,665 8	275 788	Rosevale War Bond	December
Kathleigh Fashionette II.	C. W. and E. M. Barlow, Boodua	4,665·55	275·079	Oxford Fawn's Noble	December
Kathleigh Prissie 2nd	C. W. and E. M. Barlow, Boodua	4,436·85	260 549	Oxford Fawn's Noble	December

GUERNSEY.

MATURE COW (STANDARD 350 LB.).

Linwood Sugar	H. Sanderson, Moonford	9,054·0	463 040	Warrawong Winter	October
Fernhill Ivy	H. Sanderson, Moonford	8,349·5	437 682	Laureldale Pluto	October
Fernhill Hollyhock	H. Sanderson, Moonford	8,445 5	414 924	Laureldale Peace Boy	October
Adaville Olga	J. M. Cooke, Witta	7,898 55	433 446	Laureldale Rockefeller	November

JUNIOR, 2 YEARS (STANDARD 230 LB.).

Linwood Trilby	E. G. Foxton, Maleny	4,279·15	230 863	Tattenbar Onward	October
Glenoak Bella	W. A. K. Cooke, Witta	5,376·8	283·635	Rosewood Bell Boy	November
O Kay Honey	H. Sanderson, Moonford	6,610 5	315 793	Linwood Goldfinde	December

AYRSHIRE.

JUNIOR, 2 YEARS (STANDARD 230 LB.)

Leafmore Hoaken	J. P. Ruhle, Motley	6,231·8	252 286	Myola Juggler	November

New Pure Bred Production Recording Scheme.

The following rules for official production recording of pure bred dairy cattle by the Department of Agriculture and Stock will come into operation in July, 1949:—

General.

1. This scheme shall be known as the Government Official Pure Bred Dairy Cattle Production Recording Scheme.

Official Year.

2. The official year shall commence on the first day of July and end on the thirtieth day of June.

Cows Eligible for Recording.

3. (*a*) The owner of any herd of pure bred cattle may apply for entry of his herd and shall pay the prescribed fee therefor.

(*b*) Only those cows will be accepted for test which are registered or are eligible for registration in a recognised Herd Book or Pure Stock Register.

(*c*) The owner may enter any such cows but all cows in their first lactation period shall be recorded with such exemption as set forth in Rule 18, provided that at least one-third of the registered pure bred females in the herd, with a minimum of five animals, shall be entered for recording during the year.

(*d*) The owner shall supply to the Director of Dairying when first entering cows for recording, and on 1st July in each subsequent year, an inventory of all pure bred animals on his farm.

(*e*) When a breeder owns more than one herd on separate farms each herd shall be considered and recorded as a separate herd. Any cow commencing her record on one farm shall be credited to the herd on that property though she may complete her record on another property of the same owner.

(*f*) The Recorder shall record the identification number and markings of each animal on an approved form prepared for the purpose by the Department of Agriculture and Stock. He shall check these particulars on each test and shall satisfy himself as to the identity of each animal. If the cow is not marked according to the records of the particular Breed Society, or the markings are indistinct, the Recorder shall report the fact to the Director of Dairying, who will report to the Society and the matter will then become an issue between the Society and the owner. Pending finality the cow will be recorded but no figures of production will be published.

Fees for Recording.

4. (*a*) Each herd owner shall pay to the Department of Agriculture and Stock on entry of his herd and annually thereafter a herd entry fee of £2 together with a fee of 10s. renewable at each lactation for each cow submitted for recording.

(*b*) On withdrawal of a herd, recording of all cows shall cease unless the owner is prepared to pay for each cow calving in the interim and up to actual date of withdrawal.

Period of Official Test.

5. (*a*) The official lactation period shall be 273 days. This may be extended to 305 or 365 days, on the request of the owner, provided the cow has produced the standard amount of butterfat as prescribed in Rule 17. Such request must be submitted to the Director of Dairying not later than one month prior to the expiration of the 273 days period.

The official lactation period shall commence five clear days after calving. The first five days' yield after calving shall not be included in the recording period.

Computing Official Records.

6. The yield for the official lactation period shall be calculated as follows:—

(*a*) The lactation period shall consist in the case of the 273 days record of 9 sub-periods, covering respectively 8 sub-periods of 30 days and 1 of 33 days; in the case of the 305 days record it shall consist of 9 sub-periods of 30 days and 1 of 35 days; in the case of the 365 days record, of 11 sub-periods of 30 days and 1 of 35 days, except in the case of cows not completing in full the final sub-period, in which case the lactation shall conclude with a sub-period of the completed number of days.

(*b*) The cows shall be recorded once in each sub-period at approximately equal intervals of time.

(*c*) The official yield shall be the sum of the yields of each sub-period.

(*d*) The yield for each sub-period shall be calculated as follows:—

The milk yield shall be the amount (lb.) of milk yielded over 24 hours multiplied by the length of the sub-period.

The butterfat yield shall be the amount of butterfat (lb.) calculated by test of the same 24 hours' milk yield multiplied by the length of the sub-period.

7. The recordings shall be carried out as far as possible at intervals of 30 days (vide rule 6 (*b*)). In the event of it not being possible so to do the recordings may be carried out not more than 35 days nor less than 25 days after the preceding recording, and if this is not practicable, the calculations for the period under record shall be averaged as in the case of an abnormal recording (vide rule 8), except that, in addition to the records of the preceding and succeeding recordings, the weights and tests of the sub-period under review when taken will also be included.

Additional visits may be made for the purpose of taking supplementary samples at any time.

Averaging Abnormal Records.

8. In the case of a cow appearing to be sick or recording abnormally, i.e., more than 25 per cent. above or below average of the proximate and succeeding recordings, such recordings shall not be registered, but an average shall be made from the proximate and succeeding recordings. The same course shall also be followed in the case of a cow whose sample is, or has become, unavailable for correct testing. Any such sickness shall be reported to the Department by the Official Recorder. Where the

first test is abnormal or the sample is or has become unavailable it shall be discarded, and the yield for the first sub-period shall be calculated on the average test of the next two periods.

Where First Test is Taken More than 35 Days after Calving.

9. When an owner commences to record his herd for the first time or where it has been impracticable to record certain cows until after they have calved for a period of more than 35 days, the Director of Dairying may, on receipt of a statutory declaration from the owner, or other acceptable proof as to the date of calving, credit such cows' yields with 60 days' production, based on the first 24 hours' record. Cows which have calved more than 60 days before the first test shall not be accepted for recording until the next lactation period.

Who shall be Official Recorders.

10. (*a*) The Official Recorder shall be an officer of, or approved by, the Department of Agriculture and Stock.

Where Testing shall be Carried Out.

10. (*b*) Testing shall be carried out either on the farm or the samples may be taken by the Recorder under adequate protection to be tested at some approved centre.

Official Supervision.

11. The owner must state at the time of entry, or when requested by the Recorder, the hours at which he intends to commence milkings. These times are then to be regarded as the scheduled milking hours, and must not be varied without first giving the Director of Dairying seven days' preliminary notice. The Recorder shall have the right to see that all cows are milked out under his supervision at the milking prior to the official 24 hours' test commencing and shall note the time each individual cow shall be finished so that the 24 hour period shall not be exceeded.

Daily Weighing and Recording.

12. (*a*) In recording such cow as provided for in Rule 6 (*b*) the Recorder shall weigh, on officially approved scales, the milk yield at each of the consecutive milkings which are to constitute the test and record same. After thoroughly mixing such milk the Recorder shall take a sample for the official test. The milk from each milking may be recorded and tested as separate units, or a composite sample may be taken of the milkings. No milk weight shall be credited to any cow unless the aggregate of all milkings in the 24 hours totals 4 lb. or over.

(*b*) No cow shall be stripped more than once after each milking during the recording. Where milking machines are used stripping (if practised) shall be carried out immediately after the machines are removed. Where cows are milked by hand the milking and stripping shall constitute one operation.

(*c*) Where cows are being milked by machines a vacuum bucket shall be used during the period of the Recorder's visit.

Number of Milkings per Day.

13. No cow shall be milked more than twice per day unless she is yielding more than 60 lb. of milk per day. In such circumstances milking three times per day may be permitted only until such time as the yield falls to 50 lb. per day, when twice per day milking must be practised.

The Director of Dairying may, under special circumstances, permit a variation of the above condition.

Accommodation of Recorders.

14. Every facility is to be afforded by the herd owner to Recorders carrying out their duties in connection with the scheme and accommodation shall be provided overnight if necessary.

Particulars of Date of Calving, &c.

15. (*a*) Owners must supply on the request of the Director of Dairying particulars as to the date of calving and services, manner of feeding and details as to the class, quantity of food, &c., and any other details regarding the rations fed during the period of the test and when requested by the Director of Dairying shall allow samples of the different foods used to be taken for analysis.

(*b*) All particulars required by the Director of Dairying shall be made by statutory declaration when deemed necessary.

Issue of Records.

16. (*a*) All calculations shall be made, recorded and published in terms of pounds of milk and butterfat only.

(*b*) Records of all cows submitted to the official recording shall be published, including those that fail to reach the official standard, and cows milked three times per day shall be indicated.

17. The standards for 273 days period upon which certificates shall be issued are as follows:—

Junior 2 year old	230 lb. butterfat
Senior 2 ,, ,, ...	250 ,, ,,
Junior 3 ,, ,, ...	270 ,, ,,
Senior 3 ,, ,, ...	290 ,, ,,
Junior 4 ,, ,, ...	310 ,, ,,
Senior 4 ,, ,, ...	330 ,, ,,
Mature cows	350 ,, ,,

"Junior" applies to any animal whose date of freshening falls within the first six months of the age indicated and "Senior" within the second six months.

Exemptions.

18. (*a*) Exemption from the test may be granted on a written application from the owner stating exceptional circumstances and endorsed by the Director of Dairying in respect of cows that are sick, diseased or injured, in such a manner as, in the opinion of the Director of Dairying, to seriously impair such cow's capacity for milk production.

(*b*) Any cow that aborts her calf during a lactation period shall forthwith be withdrawn from the test; she may, however, be re-entered for a new lactation if the owner so desires.

Feeding Milk or Cream to Cows.

19. The feeding of whole milk or cream to cows undergoing recording is prohibited as being a wasteful practice. Any records obtained from cows so fed will be disallowed.

Disqualifications.

20. Should the owner of any herd entered for recording not conform to these regulations, or by any act or improper practice pervert the record of the herd or any cow thereof, such herd shall be subject to disqualification for such period as the Minister may determine.

21. No person who has at any time been a member of the Scheme shall have any claim for damages of any nature whatsoever against His Majesty the King, the Government or any officer or employee of the Government for anything done or omitted to be done in connection with the Scheme and the recording of any cow.

Interpretation.

22. In all matters relating to recording, the ruling of the Director of Dairying shall be final.

QUEENSLAND SHOW DATES.

Barcaldine	May 13-14
Beaudesert	May 6-7
Beenleigh	September 16-17
Biggenden	April 28-29
Blackbutt	June 3-4
Boonah	June 3-4
Bowen	July 6-7
Brisbane R.N.A.	August 6-13
Bundaberg	June 9-11
Cairns	July 19-21
Charleville	May 18-19
Childers	June 6-7
Chinchilla	April 7-9
Cooyar	March 12
Crow's Nest	May 27-28
Dalby	March 31-April 2
Dirranbandi	May 27-28
Esk	July 1-2
Gatton	July 21-23
Gayndah	April 21-22
Gin Gin	June 13-14
Goombungee	May 21
Goomeri	May 24-25
Goondiwindi	April 30-May 2
Gympie	May 26-28
Home Hill	July 1-2
Ingham	July 15-16
Inglewood	March 11-12
Ipswich	May 17-19
Jandowae	April 4-5
Kalbar	May 28
Kilcoy	June 24-25
Kilkivan	June 10-11
Kingaroy	May 5-7
Laidley	July 8-9
Lawnton	July 29-30
Longreach	May 3-5
Lowood	June 10-13
Mackay	June 28-30
Maleny	May 12-13
Marburg	May 13-14
Maryborough	June 2-4
Miles	April 12-13
Millmerran	March 1-2
Mitchell	May 11-12
Mount Morgan Show	June 2-3
Mt. Morgan Camp Draft	June 4
Mundubbera	May 6-7
Murgon	May 19-21
Nambour	July 7-9
Nanango	April 28-30
Oakey	March 4-5
Pittsworth	March 8-9
Proserpine	July 1-2
Redlands	July 15-16
Rockhampton	June 22-25
Roma	May 4-5
Rosewood	July 15-16
Tara	March 29-30
Toogoolawah	June 17-18
Toowoomba	March 19-24
Townsville	July 12-14
Wallumbilla	April 29-30
Warrill View	May 21
Wondai	May 12-14
Woodford	July 15-16
Yarraman	April 22-23

Queensland Cheese Production, 1947-48

Compiled by Officers of the Division of Dairying.

THE quantity of cheese produced in Queensland during the year 1947-48 was 21,595,525 lb. This figure exceeds that of the previous year by 4,303,757 lb. but is the second lowest since 1941-42. Excellent seasonal conditions were experienced during the year, so the low production cannot be attributed to dry weather. It appears that the State has passed the peak of cheese production reached during the wartime diversion of milk to cheese manufacture and the figures may be expected to decline still further. This decline is being hastened by the closure of some of the smaller factories, four having ceased operations during the year 1947-48, and the increasing requirements of the whole milk trade.

The following figures show the variations in production over the past 10 years:—

	Tons.		Tons.
1938–1939	7,031	1943–1944	10,733
1939–1940	6,179	1944–1945	10,017
1940–1941	5,237	1945–1946	12,028
1941–1942	7,292	1946–1947 (Dry Year) ..	7,720
1942–1943	12,730	1947–1948	9,641

Grading.

The total quantity of cheese graded during the year was 14,155,705 lb. Quality was lower than in the previous two years, the comparative figures being:—

—	Choice and First.	Second.	Third.
	Per cent.	Per cent.	Per cent.
1945–1946	70·27	28·28	1·45
1946–1947	72·19	25·88	1·93
1947–1948	63·00	34·40	2·44

Quality is a matter to which the leaders of the industry might give greater attention. It is regrettable that of 44 factories submitting cheese for grading, only 13 had any cheese graded as choice and in only four cases did the quantity exceed 5 per cent. of the amount submitted.

Detailed statistics showing the production and gradings of individual factories are set out in the accompanying tables.

SUMMARY OF CHEESE PRODUCTION AND GRADINGS FOR THE YEAR 1947–1948.

	Lb.	
Milk Received ..	212,780,871	Yield of cheese per 100lb. milk, 10·15 lb.
Cheese Made	21,595,525	Yield per pound of butterfat, 2·61 lb.
Butterfat Paid For ..	8,282,597	Average Butterfat Test of Milk, 3·89%

GRADINGS.

Total Submitted.	Choice.	First.	Second.	Third.	Prohibited Export.
Lb.	Lb.	Lb.	Lb.	Lb.	Lb.
14,155,705 ..	204,955	8,711,940	4,870,136	345,459	22,215
	1·45%	61·55%	34·40%	2·44%	·16%

MANUFACTURE AND GRADINGS OF QUEENSLAND CHEESE FACTORIES FOR THE YEAR ENDED 30TH JUNE, 1948.

Factory.	Milk Received.	Production and Yield.					Official Gradings.					
		Cheese Green Weight.	Butterfat.	Cheese Yield.		Average Test.	Total Submitted.	Choice.	First.	Second.	Third.	Prohibited Export.
				Per 100 Lb. Milk.	Per Lb. Butterfat.							
	Lb.	Lb.	Lb.	Per cent.	Per cent.	Per cent.	Lb.	Lb.	Lb.	Lb.	Lb.	Lb.
*Aubigny	314,810	33,534	11,962	10 65	2 80	3·8	39,728	..	38,219 96·2%	1,510 3 8%	..	..
Biddeston	7,640,293	821,149	287,696	10 75	2 85	3 77	503,597	..	455,746 90 5%	47,693 9 47%	158 ·03%	..
Coalstoun Lakes	2,137,602	220,097	81,515	10 3	2·7	3·81	86,226	..	..	53,099 61·58%	32,647 37 86%	480 ·56%
Daredale	2,296,170	225,888	87,086	9 84	2·59	3·79	229,428	..	103,591 45·15%	120,457 52·50%	5,380 2·35%	..
Downs, Boodua	2,609,684	263,525	108,648	10·1	2·43	4 16	230,041	..	77,473 33·68%	128,126 56·13%	23,422 10·19%	..
Downs, Toowoomba ..	27,939,814	2,762,884	1,095,640	9·90	2 52	3·93	2,855,897	..	786,137 27·53%	1,936,005 67·79%	123,787 4·33%	9,968 ·35%
Dundarrah	1,326,800	129,660	50,817	9·77	2·55	3 83	37,809	..	..	16,775 44·37%	21,034 55·63%	..
Felton	4,228,443	439,846	161,034	10·40	2·73	3·81	249,083	..	148,466 59·61%	84,915 34·09%	15,702 6·3%	..
Greenmount	3,311,370	354,308	123,668	10 7	2 86	3 73	140,267	..	8,004 5 71%	129,133 92 06%	3,130 2 23%	..
Highgrove	1,635,449	167,022	62,619	10·21	2·67	3 83	150,722	..	13,324 8 84%	134,545 89·26%	2,853 1·89%	..
Irongate	3,874,521	386,202	143,091	9·97	2 7	3·71	354,328	21,720 6·13%	299,258 84·46%	32,385 9 14%	965 ·27%	..
Kelvinhaugh	1,516,204	158,214	56,903	10 43	2 78	3·75	136,217	..	117,922 86·57%	18,295 13·43%	..	..
Kooroongarra	4,465,901	455,789	165,281	10 21	2 76	3·7	462,875	14,823 3 2%	413,144 89·26%	34,908 7·54%	..	..
Lilyvale	2,319,791	248,699	89,411	10·72	2·78	3 85	240,513	20,999 8·73%	210,056 87·34%	9,458 3·93%	..	..
Maclagan, Maclagan ..	8,357,292	837,755	316,441	10·02	2·65	3 79	478,858	..	139,008 29 03%	324,741 67·82%	15,109 3 15%	..
Maclagan, Kulpi	7,050,876	689,550	261,265	9·78	2 64	3·71	678,944	..	466,891 68·77%	205,746 30 30%	6,307 ·93%	..
Malling	5,992,561	579,922	233,817	9 68	2 48	3 90	..	..	..	..	..	..
Maryborough, Tansey ..	5,894,472	610.957	253,362	10·36	2·41	4·3	247,779	31,688 12 79%	216,091 87·21%	..	..	..
Maxam, Cooranga North ..	6,070,833	665,406	249,971	10·96	2·66	4·12	596,032	1,437 ·24%	588,903 98 8%	5,692 ·96%	..	..
Moola	4,208,853	420,000	153,247	9·98	2·74	3·64	315,387	1,868 ·59%	227,853 72·25%	84,055 26·65%	1,611 ·51%	..
Mount Sibley	2,940,923	311,580	111,986	10·59	2·78	3·81	249,283	..	248,871 99·83%	412 ·17%	..	..
Mount Tyson	6,660,493	687,368	249.784	10·32	2·75	3·75	89,222	2,004 2·25%	79,880 89·53 %	7,338 8·22%	..	..

P ttsworth, Pittsworth ..	5,710,030	605,124	235,989	10·60	2·56	4·13	233,774	9,569 4·09%	216,214 92·49%	6,100 2·61%	..	1,801 ·81%
†Pittsworth, Brookstead ..	1,515,141	157,761	57,691	10·41	2·73	3·81	126,423	..	94,153 74·47%	32,270 25·53%	..	..
Pittsworth, Linthorpe ..	2,513,842	258,320	94,507	10·28	2·73	3 76	108,228	..	73,575 67·98%	34,653 32·02%	..	..
Pittsworth, Scrubby Mountain	2,267,374	242,174	86,940	10·68	2·79	3·83	133,556	550 ·41%	94,097 70·46%	36,547 27·36%	1,896 1·42%	466 ·35%
Pittsworth, Springside ..	2,403,198	257,780	89,672	10·73	2·87	3·73	202,833	89,313 44 03%	108,704 53 59%	4,816 2·38%	..	..
Pittsworth, Yarranlea ..	4,323,943	445,813	164,336	10·31	2·71	3·8	220,408	..	133,793 60·70%	85,194 38·65%	1,421 ·65%	..
Port Curtis, Bracewell ..	4,240,030	415,756	151.124	9·81	2·75	3·56	338,821	..	307,761 90·83%	28,332 8·36%	2,728 ·81%	..
Port Curtis, Theodore ..	2,996,236	307,452	112,958	10 26	2·72	3·77	36,704	1,468 4 0%	24,969 68·03%	1,857 5·06%	..	8,410 22·91%
Q.A.H.S. and College, Lawes	29,487	3,135	1,229	10·63	2·55	4 17	..	..	..	..	..	..
Quinalow	6,137,851	626,017	234,837	10 2	2·67	3 83	213,077	..	134,709 63 22%	74,411 34·92%	3,957 1·86%	..
Ramsay	1,892,077	193,260	74.486	10·21	2 59	3·94	167,323	..	115,296 68·91%	52,027 31·09%	..	..
Rockview	2,227,329	236,632	84.677	10·62	2·79	3 80	144,323	..	130,523 90·44%	13,800 9 56%	..	..
Rocky Creek	3,789,050	391,719	141,219	10·34	2·77	3·73	361,615	..	248,389 68·69%	103,174 28·52%	10,052 2·79%	..
Rosemount	3,243,186	312,415	124,494	9·63	2·51	3 84	247.961	..	78,566 31·68%	126,652 51·08%	42,743 17·24%	..
Southbrook	7,046,822	723,450	261,659	10 27	2·76	3 71	368,973	2,416 65%	294,212 79·74%	70,615 19 14%	1,574 ·43%	156 ·04%
South Burnett, Goomeri ..	6,145,349	634,976	252,443	10 33	2·52	4 11	586,174	..	523,482 89·30%	62,071 10·59%	621 ·11%	..
South Burnett, Murgon ..	6,003,089	588,436	241,777	9·8	2·43	4·03	459,256	..	430,360 93·71%	28,578 6·22%	318 ·07%	..
Sugarloaf	1,853,334	188,640	75,688	10·18	2·49	4·08	80,608	..	80,608 100%	..	..	..
Sunnyvale	1,633,990	171,626	64,972	10·5	2·64	3·98	143,357	..	49,594 34·59%	83,891 58·52%	9,399 6·56%	473 ·33%
Warwick, Greymare ..	2,291,129	233,512	87,217	10 19	2,68	3·81	146,467	..	37,271 25·45%	105,276 71·88%	3,920 2·67%	..
Warwick, Talgai	1,109,338	109,722	41.372	9·89	2·65	3·73	..	..	..	..	..	..
Warwick, Victoria Hill ..	585,910	61,568	21,466	10·51	2·87	3 66	.	..	..	..	..	..
Warwick, Mill Hill	21,748,357	2,095,870	909,712	9·64	2·3	4 18	797,315	7,100 0·89%	611,703 76·72%	176,146 22·09%	1,442 ·18%	924 ·12%
Woodleigh	1,393,627	139,327	52,723	10 00	2·64	3·78	130,952	..	20,473 15·63%	101,481 77·5%	8,551 6·53%	447 ·34%
Yamsion	3,280,659	353,735	123,949	10·78	2 85	3·78	349,665	..	147,720 42·25%	198.830 56·86%	3,115 ·89%	..
Yargullen	3,696,394	384,729	142,610	10·41	2·70	3·86	185,656	..	116,932 62·98%	67,127 36·16%	1,597 ·86%	..
Totals	212,780,871	21,595,525	8,282,597	..	..	..	14,155,705	204,955 1·45%	8,711,940 61·55%	4,870,136 34·40%	345,459 2·44%	22,215 ·16%

* Ceased operations 30–9–47. † Closed from 1–4–48 to 30–6–48.

DIVISION OF DAIRYING.

GROUP HERD RECORDING SCHEME.

Summary of Herd Recording Units for December, 1948.

District.	No. of Herds.	No. of Cows.	Group Daily Average.			Average of Highest Herd.		
			Milk. Lb.	Test. %	Fat. Lb.	Milk. Lb.	Test. %	Fat. Lb.
Beaudesert ..	17	888	16·58	4·11	·681	21·64	5·07	1·097
Maleny No. 1 ..	17	713	15·02	4·64	·697	19·51	5·58	1·089
Maleny No. 2 ..	17	694	16·04	4·56	·732	32·86	4·91	1·615
Oakey No. 1 ..	22	715	18·91	4·34	·822	22·21	5·31	1·178
Oakey No. 2 ..	22	746	20·44	4·23	·865	34·7	3·96	1·373
Goomeri	17	678	13·02	3·82	·498	19·64	4·37	·859
Cooroy No. 1 ..	22	780	10·2	3·84	·391	25·89	4·15	1·075
Cooroy No. 2 ..	22	675	8·67	3·89	·337	11·7	4·35	·509
Kingaroy No. 1 ..	20	784	14·54	3·93	·572	25·11	4·01	1·016
Kingaroy No. 2 ..	20	723	18·21	3·88	·706	24·77	4·03	·998
Cedar Pocket ..	22	626	16·55	4·31	·714	25·53	4·35	1·111
Monto	21	772	21·77	4·07	886	32·44	3·99	1·296
Pomona	16	614	13·8	3·92	·541	20·82	4·25	·885
Miva-Theebine ..	16	733	12·66	4·25	·538	15·2	4·51	·685
Warwick	20	720	22·1	3·84	·847	34·66	3·94	1·365
Kenilworth ..	18	845	10·68	3·85	·411	21·92	3·41	·748
Killarney	20	856	18·74	4·28	·803	23·07	5·03	1·16
Toogoolawah ..	16	770	12·99	3·91	·508	22·02	4·44	·978
Toowoomba No. 1	22	709	17·56	4·33	·76	20·00	5·34	1·067
Toowoomba No. 2	19	875	18·07	4·12	·745	28·78	3·86	1·112
Malanda	22	811	14·83	3·73	·553	29·67	3·08	1·093
Kilcoy	20	802	13·23	3·92	·519	22·24	4·37	·973
Millaa Millaa ..	12	394	12·6	3·92	·494	15·73	3·79	·596

Fat Lamb Production in Queensland.

G. R. MOULE, Officer in Charge, Sheep and Wool Branch.

(*Continued from page 48, January, 1949.*)

MANAGEMENT OF THE FLOCK.

In any branch of sheep raising, flock management is important. Fat lamb raising in Queensland is a more specialised phase of primary production than it is in the southern States, which enjoy good seasonal conditions. The predominantly summer rainfall and the close association between lamb production and agriculture in Queensland necessitate practices which are somewhat different from those applicable in other States. However, the basic principles are quite similar.

Selection of Breeds of Sheep.

Sheep are used to convert crops into cash in lamb production in this State. Accordingly, it is essential to select the breeds of sheep which will do this most efficiently. From the section dealing with sheep breeding, it is seen that the best lambs are likely to be produced by crossing long-woolled rams such as Romney Marsh, Border Leicester, or Corriedale with Merino ewes and mating the female offspring with Dorset Horn or Southdown rams. As the majority of farming lands on the Darling Downs are too valuable to use for the growing of first-cross sheep, the lamb-raiser in that area would be well advised to buy a good line of Border Leicester x Merino, Romney Marsh x Merino, or Corriedale x Merino ewes to mate with Dorset Horn and/or Southdown rams.

The man who wishes to raise lambs but who is situated in areas which are not quite so favoured as the Darling Downs would be well advised to concentrate on first-crosses, such as Border Leicester x Merino, Romney Marsh x Merino, or Corriedale x Merino. The female offspring from such crosses meet a ready sale in the lamb-growing areas as fat lamb mothers. The male offspring can be fattened on whatever crops happen to be available and turned off as heavyweight lamb or young mutton suitable for the local trade. In addition, there is a fairly good return from the wool of such crossbreds. Areas which would be suitable for such a system of husbandry include those as far west as Roma in the south, parts of the Dawson Valley, the Burnett and Callide Valleys, and Peak Downs.

It would be advisable for any farmer who wished to rear sheep in the coastal or subcoastal areas, such as Beaudesert or Laidley, the irrigated areas of the Burdekin basin, the Atherton Tablelands, or Springbrook, to introduce Romney Marsh or Romney x Merino crossbreds.

It is far better to buy a straight, even line of ewes than to retain any females which fail to reach a marketable condition each year to act as replacements. Lambs which fail to reach a *marketable weight* by the time they attain a *marketable age* have really demonstrated their slow-growing and late-maturing qualities and accordingly they are most undesirable as lamb mothers.

Ewe Classing.

The classing of ewes is important to the lamb producer just as it is to the wool grower. The fat lamb mother should produce a profitable fleece as well as breed and rear at least one marketable lamb each year. Accordingly, it is advisable to examine the ewes each year before mating. Besides rejecting the broken-mouthed ewes, any animals which are bad mothers, which have blind teats or defective udders, which are shy breeders or poor wool cutters, or which repeatedly produce unmarketable lambs should be withdrawn from the flock. Failure to do this means that the space and crops which could be utilised by a profitable sheep are given to unprofitable ones; in other words, money is being wasted.

Mating.

The main factor which will govern the date of mating the rams with the ewes will be the amount of feed it is anticipated will be available for the lambs when they are dropped. On the Darling Downs, where winter crops such as oats are utilised for lamb production, it is desirable to drop the lambs between early March and late May, and this means mating between October and January.

As the early lamb is the most profitable, some growers on the Darling Downs mate Dorset Horn and Southdown rams at the same time with the ewe flock. There is field evidence to suggest that the presence of active rams which are keen to work has the effect of bringing ewes on heat and the Dorsets, with their capacity to work, probably have a useful influence in this way.

In other areas the type of crops grown—that is, whether summer or winter—will have the deciding influence on mating time.

Neither ewes nor rams should be over-fat when mated. It is probably advisable to mate 2½ per cent. of young rams or 3½ per cent. of old rams and it is a well-established custom "to flush" the ewes by joining on green feed. This is considered to lead to more frequent twinning. The rams should be in good order for mating and it is unwise to use any animals which have suffered recently from sore feet or any other upset.

Care of the In-lamb Ewe.

Very often ewes in lamb are turned out on to natural pastures and are not brought in until they lamb. This practice is fairly satisfactory when the sheep have been mated in October if good summer rains fall and if the native grasses are of reasonably good quality. If, however,

the summer rains fail, the natural pastures are of poor quality, or the sheep have been mated in the autumn for a spring lambing to catch summer crops in a summer rainfall area, this practice cannot be commended. It is preferable to keep the ewes on a steadily rising plane of nutrition during pregnancy. This will ensure a better milk supply and bigger lambs, particularly if there is a large number of twins, and at the same time will assist greatly in minimising losses due to the so-called twin-lamb disease or pregnancy toxaemia. Where it can be arranged it is preferable to "top the ewes off" during the last month or so of pregnancy. This can be managed quite conveniently after the pre-lambing crutching and will give the ewes a chance to settle down in their new pasture. At the same time it reduces the amount of handling of the ewes to a minimum. Naturally, the extent to which "topping off" can be practised will depend upon the area of the farm and the proportion under crops, but on no account should the ewes be allowed to get too fat.

It is also advisable to keep moving amongst the ewes. This accustoms them to the regular visits which are necessary at lambing time, when it may be possible to help a ewe which is experiencing difficulty.

Many lambs are lost each year as the result of the activities of wild dogs, foxes, eagles, crows, or hawks. This is partly the result of the marked increase in such wild life during the war, but it is as well to make every effort to trap and/or poison these predators before lambing commences.

It is preferable, wherever possible, to lamb the ewes in paddocks which have adequate cover to afford protection for the ewes and their young lambs. Shade is necessary but at the same time good feed for the ewe should be readily available.

Care at Lambing Time.

The gestation period of the ewe is usually stated to be five months, and at lambing time the ewes should be in good strong condition and not over-fat.

Owing to the cold conditions experienced on the Darling Downs during winter it is advisable to use sheltered paddocks for lambing in order to minimise losses of young lambs.

Attention to the ewes at lambing time will pay handsome dividends. If possible, two inspections should be made each day, one early in the morning to assist any ewes which may have got down during the night.

In dealing with ewes which are apparently having trouble in lambing it is as well to remember the following points:—

(1) Do not be impatient; make sure the ewe is in trouble before you interfere;

(2) Always explore the situation thoroughly before exerting any force;

(3) Keep the fingernails short and the hands clean.

Lamb Marking.

Lamb marking, which consists of ear marking, docking the lamb's tail, and castrating the males, is most easily performed when the lambs are very young. It is the aim of the lamb producer to keep the sheep

growing and fattening and to avoid any setbacks. The earlier the lamb is marked the fewer after-effects are experienced, and recovery from the operations is quicker. The time and the method of marking vary from property to property. Most owners quietly draft ewes with lambs out of the lambing paddock into one which contains a crop at a stage suitable for grazing. They then have two or three markings, one every two or three weeks. Others mark the lambs, if they are strong enough, when the ewes are moved from the lambing paddock.

Whatever procedure is adopted it is essential to take reasonable precautions. It is preferable to use temporary yards and, if it is necessary to use a permanent yard, to hold the lambs on an outside fence for the marking operation and drop them on their feet into a clean paddock in which the ewes are confined to allow mothering. Make sure all the instruments are clean, and do not attempt marking during cold, wet weather.

From Marking to Marketing.

Provided the sheep are of the right breeding, correct feeding is the key to the successful production of fat lambs. It is as well to remember that in Queensland, where crops are grown especially for feeding lambs, it is essential that they be utilised with the utmost efficiency, because of the expense involved in preparing for and sowing crops. Lambs which develop rapidly and are marketable at an early age are most profitable because they are on the property a minimum time and they utilise their food with the greatest efficiency—that is, they are off the property before the efficiency with which they convert their food to meat falls, and before they commence to eat an increasingly large amount of the crop to make progressively smaller gains in liveweight.

The way in which the lambs are fed from marking till they are ready for market has an important influence on the quality of the carcase. It is as well to remember that as the lamb grows older there is a steady increase in its nutritive requirements and at the same time a steady decrease in the amount of milk its mother produces. Accordingly, to ensure a steadily rising plane of nutrition for the lambs it is essential to regulate the grazing of crops carefully.

Of the crops grown on the Darling Downs for lamb production, oats is probably the most popular. When treated as a pasture it is perhaps one of the most productive of those grown under "wheat belt conditions" and needs no cultivation other than preparation of the land and seeding. If it is planned to lamb early, it may be worth considering seeding "early" and "late" varieties in different paddocks. A succession of individual sowings between February and June will normally ensure a continuous supply of succulent, nutritious forage essential for best results. Klein, Algerian, Mulga, and Fulghum are the recommended varieties.

In fat lamb production, rotational grazing of the oat "pastures" gives the best result from the point of view of crop utilisation and worm control. This usually involves the crowding of the ewes on to a part of the paddock which is divided off by a temporary fence. It is advisable to keep the sheep on this area until it is eaten down.

Legumes which can be used for lamb production are lucerne and cowpeas. Lucerne is fairly expensive to establish over large areas on account of the careful seed-bed preparation necessary and the problem

of mint weed in infested districts. Grazing should not be carried out until the plants have established a crown. This is usually after the first flowering and shoots appear at the base of the plant. As it is a "long term" project, the first grazing should be light. Once plants are well established they may be grazed whenever there is sufficient growth and this occurs mainly in the warmer months. Lucerne paddocks should not be grazed, however, during dry months when they are comparatively bare. Accordingly, lucerne paddocks may appear unproductive at certain times of the year when compared with those which produce a cereal crop.

The main value of lucerne lies in the quality of the feed it produces and its longevity. Lucerne is rich in protein and, as the growing stage of young animals is virtually a period of rapid protein storage, it is important to provide them with a high protein intake. Another advantage is that any surplus lucerne can be cut easily and conserved.

For rapid fattening of sheep in the summer, cowpeas have few equals. They are particularly handy for finishing off a line of lambs and should be grazed as the pods are reaching maturity. Cowpeas are also rich in protein but unlike lucerne are quick-growing annuals. Unfortunately, a good deal of the plant is wasted by grazing. Sheep do not eat the main stems and these usually blow away and are not available as a source of humus. Cowpeas do particularly well under a wide range of conditions in Queensland. Sown from September to January they mature from December to May, but are susceptible to frost. They can be grown in the 26 inch rainfall zone, but a clean seed-bed is an essential.

Rape is a valuable crop in that it has the capacity, if planted early, of providing feed during the autumn months and may persist right into the following spring provided adequate rain falls.

Sudan grass is a summer grower. It is an annual and has the reputation of being fairly drought resistant. It can be grazed by sheep and is becoming a more popular crop for this purpose. White panicum is another quick growing summer annual which provides a good succession of grazings. However, both of these crops are inclined to be deficient in protein and accordingly, when they are used, care should be taken to provide the sheep with some protein-rich plant such as lucerne or peas.

Unfortunately, permanent pastures of exotic species are not well established in Queensland, but it seems from recent work conducted by C.S.I.R. that *Paspalum scrobiculatum* may be a useful summer growing species for this State. Should this grass do as well in the field as it has under experimental conditions, it seems probable that it will lead to considerable extension of the lamb producing areas in the summer rainfall zones, and after all improved pastures are the key to an established lamb industry.

In marketing it is advisable to forward the lambs as soon as they reach the best weights. It is usually considered that the dressed weight of a lamb is about half its live-weight, though this varies a little depending on breed and age. However, it is inadvisable to hold lambs too long in the hope that they will attain heavier weights. Carcases between 29 and 42 lb. weight are the most popular and holding sheep too long may mean they will get too fat.

The lamb grower on the Darling Downs should aim at selling all lambs, irrespective of sex. Men in the marginal lamb country might consider retaining the female offspring for sale as fat lamb mothers on the Darling Downs.

The quality of the final product depends largely upon the way the lambs are handled when being forwarded to market. Careless work in the yards, forcing lambs into too small an area, throwing sheep over fences, catching them by their wool or prodding them with sticks may cause bruising of the carcase. Many first-grade lambs are rejected from export as the result of such rough handling. If it is necessary to drive the lambs some distance to the trucking yards, it is as well to take a few ewes along with them. It is advisable to start the lambs off for the trucking yards early in the morning or late in the evening so that they will not have to travel during the heat of the day. It is also advisable to allow ample time for work of this nature so that the lambs can cool down and have a drink before going on trucks.

Where motor transport is being used, the trucks usually pick up the lambs on the property and under these circumstances the sheep have not to be mustered until the day they are leaving the property. This reduces the time the lambs are off their mothers prior to slaughtering and means a minimum loss of weight and bloom.

While the object in lamb production is to get the whole drop off to market within about 16 weeks of birth this is seldom achieved. A few animals have to be carried over and marketed later. Sometimes these "carry overs" go off as "summer" lambs 10 or 11 months old.

If lambs are being carried over past Christmas it is advisable to shear them before the summer rains fall. There is no doubt that sheep usually fatten quickly off shears and a December or January shearing reduces the risk of trouble from grass seed.

SHEEP DISEASES ASSOCIATED WITH FAT LAMB PRODUCTION.

The main diseases and parasites affecting sheep are dealt with in greater detail in other Departmental pamphlets. In this section a brief summary is given of diseases of breeding ewes, diseases associated with lamb marking and worm control for the lamb grower.

Diseases of Breeding Ewes.

There are three important diseases which occur commonly amongst breeding ewes in the lamb industry. These are twin lamb disease (pregnancy toxaemia), milk fever (hypocalcaemia), and grass or oat tetany (hypomagnesaemia).

The name twin lamb disease suggests that this complaint is restricted to ewes carrying twin lambs. However, this is not always the case, as it may occur in ewes carrying only one lamb, though under these circumstances affected animals are usually fairly well advanced in pregnancy.

The exact nature of the changes which occur in the ewe's body during the course of this disease is not fully understood, but the condition occurs most commonly when ewes within about one month of lambing are subjected to adverse conditions such as a falling plane of

nutrition. Other factors, such as cold, wet weather, a change of paddock or holding in the yards too long, may precipitate outbreaks. Initially a few intermittent cases occur, but the number of sheep affected increases gradually. The losses cease immediately lambing finishes.

"Milk fever" suggests a feverish condition associated with the production of milk. Actually this is not the case. This disease and grass or oat tetany are caused through a sudden change in the amount of minerals circulating in the blood. Milk fever results from sudden diminution in the calcium content of the blood, while oat tetany occurs when the amount of magnesium carried in the blood suddenly decreases. A large number of factors are known to predispose sheep or to precipitate attacks of milk fever. These include a diet which is deficient in calcium (lime), periods of starvation, exercise, infestation with worms, cold wet weather and certain poison plants. Outbreaks of milk fever often occur suddenly, a large number of sheep being affected at once. Cases may occur prior to, during or after lambing.

As its name suggests, oat tetany often occurs amongst sheep which are grazing on oats. Sheep affected by twin lamb disease, milk fever or grass tetany may present fairly similar symptoms, which include grinding of the teeth, a dull stupor, and disinclination or inability to move. Sometimes the sheep go down and give the impression of being paralysed. The course of twin lamb disease is inclined to be long and drawn out, death following in from 5 to 7 days, whereas in both milk fever and oat tetany it is short. Plate 49 shows a ewe suffering from pregnancy toxaemia.

Both milk fever and oat tetany will respond readily to treatment. The logical thing to do when sheep are affected is to inject some calcium (lime) and/or magnesium. This has the effect of increasing the amount

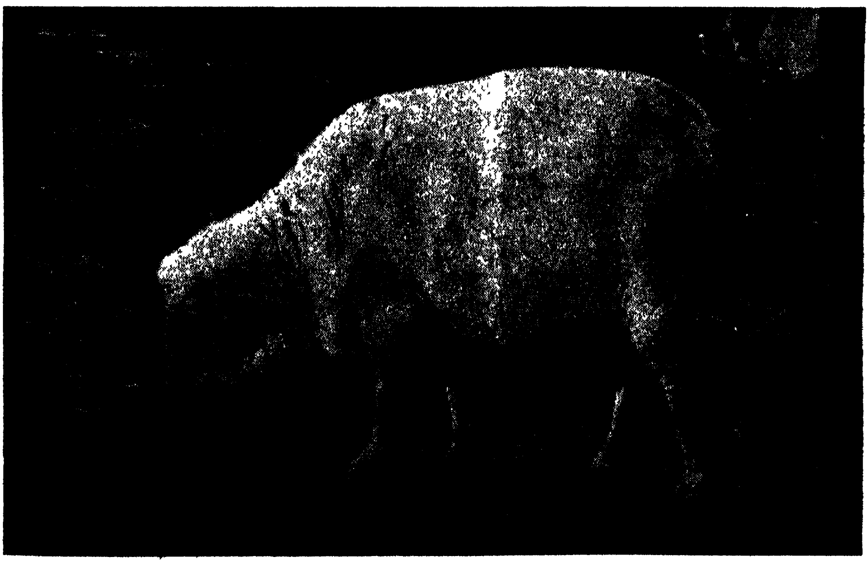


Plate 49.

A Ewe Suffering from Pregnancy Toxaemia.

of these minerals circulating in the blood. A suitable procedure is to inject the calcium (lime) first and, if there is no response within about 15 minutes, inject the magnesium. If the sheep still does not respond and the symptoms and history are similar to those described it is reasonably certain the trouble is twin lamb disease.

The dose rates are as follows:—For milk fever 30-50 c.c. of a 20% (1 in 5) solution of calcium-boro-gluconate injected under the skin; for oat tetany 15 c.c. of a 5% (1 in 20) solution of magnesium sulphate (Epsom salts).

Precautionary measures include the avoidance of those conditions which are known to predispose animals to attacks of these diseases.

Diseases Associated with Lamb Marking.

There are some important diseases which may affect lambs after marking. They are caused through specific bacteria gaining entrance to the blood stream through the marking wounds. The organisms which cause these diseases are found commonly in the soil, especially in the vicinity of established sheep yards and shearing sheds. Accordingly, these places should be regarded as unsuitable for carrying out marking operations.

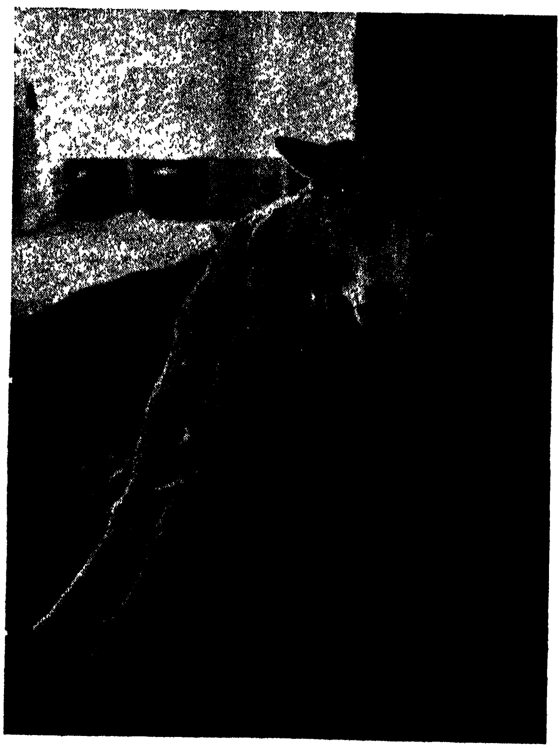


Plate 50.

A LAMB SUFFERING FROM TETANUS.

Gas gangrene, malignant oedema, white oedema and tetanus are diseases caused by organisms which are called anaerobes because they cannot thrive in an environment in which oxygen is present. Accordingly, when exposed to the air they develop a strongly protective "seed coat" and in this stage are known as spores. These spores are very resistant to hot dry weather and sunlight.

On entering the lamb's body through marking wounds the organisms which cause gas gangrene, malignant oedema and white oedema soon multiply. They set up a large swelling which rapidly extends and which varies in colour from blackish-red to white depending on the type of infection. Affected lambs become acutely lame and feverish. They are disinclined to eat and usually die within about a week of being marked.

On the other hand, the organism which causes tetanus does not invade the tissues surrounding the wound through which it enters. Accordingly, the marking wounds may appear perfectly normal at all times, but within any time between about 7 and 14 days after marking lambs may become stiff legged and tend to take fit-like seizures. Finally they go down on their sides with their front legs stretched out stiffly. Death usually supervenes. Plate 50 shows a lamb suffering from tetanus.

Two other diseases associated with lamb marking are arthritis and cheesy gland (*caseous lymphadenitis*). In the former condition the causative organism, on gaining entrance to the blood stream through the marking wounds, circulates around the body until it reaches a joint. Here it becomes established and sets up a considerable amount of inflammation. Symptoms of lameness, disinclination to eat and/or drink, general malaise and soreness of the joints may appear in from one to three weeks after marking.

Few lambs die from arthritis but many may be affected and in this way receive a check in their growth. A few lambs become more or less permanent cripples.

The main economic importance of cheesy gland is that affected carcases are rejected for export. The causative organism of this disease may gain entrance through the marking wounds and forms cold abscesses in the various lymph glands. These abscesses are virtually unimportant while the animal is alive and usually escape notice. They are readily detected, however, on postmortem examination at the meatworks.

Worm Control.

Internal parasites have played an important part in governing the distribution of sheep in this State. Largely because of them, sheep raising on the coast has, in the past, been unsuccessful. Worms are controllable, however, by the application of more modern methods.

There are three species of worms which commonly affect sheep in Queensland. These are the barber's pole worm (*Haemonchus contortus*), found in the small intestine, and the nodule worm (*Oesophagostomum columbianum*) found in the "crown" of the large intestine. The barber's pole worm is more common during the summer months, while the hair and nodule worms occur mainly in the winter. All three species are much more prevalent in wet seasons.

The barber's pole worm is a blood sucker and a heavy infestation can produce marked anaemia in lambs.They become unthrifty, pot-bellied and fail to grow. The skin of their eyelids and gums becomes pale and often a soft swelling develops under the jaw. If untreated the lambs may die.

The hair worm causes black scours in young sheep and associated with this symptom there is an apparent inability on the part of the animal to utilise its food. Accordingly, affected lambs do not grow and are hard to fatten.

The nodule worm produces poverty and emaciation in both young and old sheep. The gait becomes stilted and the animals have a peculiarly humped back.

Two important principles are involved in worm control for the lamb raiser. They are:—

(1) Keep the ewes free from worms.

(2) Feed the lambs well.

The worm burden carried by the ewes can be kept at a minimum by drenching these sheep twice a year, once in late April or early May and once in mid-August, with phenothiazine (which is effective against the common worms) and using bluestone and nicotine sulphate during the winter and bluestone and arsenic during the summer, as the season demands. It is good policy to drench the ewes prior to lambing but care should be taken not to use phenothiazine within about four weeks of lambing. After drenching, the ewes should if possible be put into a clean paddock—that is, one which has not been stocked for three or four weeks.

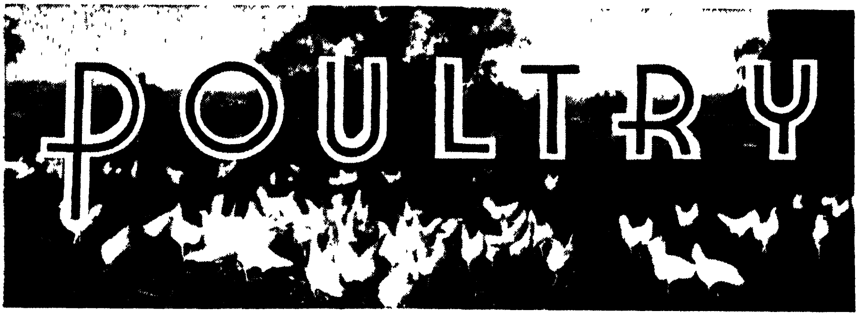
It has been demonstrated clearly that well fed lambs are not as likely to suffer from worm infestation as are poorly fed animals. It is also known that rotational grazing of pasture is helpful in that it breaks the life cycle of the worms and minimises the risk of reinfestation. Accordingly lambs whose mothers have been drenched prior to lambing, and which are well fed and moved from one paddock or part of a paddock to another at least every three weeks, have a reasonable chance of fattening well and not requiring any anthelmentic treatment. Should this be necessary, however, the phenothiazine drench is probably the best to use.

ACKNOWLEDGEMENTS.

In preparing this article information has been drawn freely from data already published by other workers in the field of animal production.

The assistance of officers of the Division of Plant Industry, Department of Agriculture and Stock, and of various men interested in and familiar with the lamb industry in Queensland is also acknowledged.

Most of the photographs have been supplied through the courtesy of *Queensland Country Life*, and appreciation of this assistance is recorded.



The Production of Poultry Meat.

P. RUMBALL, Officer-in-Charge, Poultry Branch.

THE relatively high price now being paid for poultry meat is inducing many farmers to give consideration to a phase of poultry raising that has been sadly neglected in the past.

It is necessary for the guidance of those intending to raise poultry for meat to stress the fact that a very large percentage of the poultry slaughtered in the Brisbane area is being exported overseas. The export trade is responsible for the present prices and only birds that are well-fleshed, free from deformities, and, when dressed, attractive in appearance are suited for this trade.

Demand.

Although there is a sale for small, young birds weighing from $\frac{3}{4}$ to $1\frac{1}{2}$ lb. upon the local market for grilling purposes, the demand is limited. The market at present is unlimited for young males of a minimum of 3 lb. for export purposes. It is necessary, however, that the farmer when marketing study the feather development. Birds with excessive pin feathers, especially black-plumaged birds, do not dress attractively enough for export. The ruling price for hens of export quality is also highly attractive. Those that are to be marketed should not be retained until they have commenced to moult and are smothered in pin feathers. Farmers specialising in the production of table birds, should, for economic purposes, confine their attention to cockerels.

Where to Procure Chickens.

For economy in production it is necessary for chickens to have a good start in life and to see that mortality is kept down to a minimum. For this reason it is recommended that buyers of cockerels obtain their supplies direct from a hatchery. Hatchery chickens have not been exposed to the possibility of chills, as is often the case with chickens sold in markets, nor have they been exposed to infection from adults.

Methods of Rearing.

It is necessary for success to give cockerel chickens the same careful attention that is given to the raising of their more valued sisters. They should be reared in brooders until they have reached that stage of development when heat is not necessary for their well-being. This stage would be when they are from 3 to 4 weeks of age in warm weather and may extend to 6 weeks in the winter.

At six weeks of age they could be placed in batteries, and housed intensively or semi-intensively until they have reached that stage of development at which they are to be sold. In rearing for table purposes it is necessary to obtain the maximum growth for the minimum expenditure of food and time. Good feeding and some curtailment of freedom assist this objective. Under either of the foregoing methods of rearing, the birds are kept close to the feed supply and food is not used for maintenance to the same extent as with birds on range.

Battery Rearing.

Batteries consist of a series of cages which may be erected in tiers in existing sheds or as a special unit outside. If a special unit, tiers are not recommended. The structure should be erected upon stumps of convenient height for working. Special units need to be well-roofed to give the necessary protection, and, as the birds are close to the roof, thatching is suggested.

The sections of the battery should be made to hold 10 to 16 birds at 6 weeks of age, and, as the birds develop, the number in each section reduced until only about half the original number is confined in each section by the time they are fit for market.

Batteries with sections 30 inches square and 20 inches high are recommended. The floor of the battery should be 1-inch square woven wire or wire-netting. If the battery is erected in tiers, it will be necessary to have dropping trays below each tier. These trays and the floor under the lower tier should be cleaned daily. Where batteries are erected in the open the back should be closed but provision should be made for ventilation on hot days. Partitions between sections could consist of wire netting, but, if the section is long, erect a closed section every 5 to 6 sections to check drafts. Feed and water vessels for convenience of working are hung outside the front of the battery. For this reason the front is constructed of upright wire or thin slabs of wood spaced sufficiently wide apart to allow the bird's head to pass through. If Leghorns are to be reared to an advanced age, front sections suitable for 6-weeks' old chickens will be too narrow for the older birds. It is better, as numbers have to be reduced from time to time, to have separate sections for older birds.

House or House and Yard Rearing.

Cockerels may be successfully reared in houses only or in houses with run attached. It is very desirable to restrict the area of the run and have as few in a group as the general farm plant will allow. It is appreciated that upon many farms with the existing buildings small numbers would not be economically sound.

Where cockerels are to be reared in houses with runs, it is as well to commence by allowing for 6-weeks' old birds two square feet of floor space in the house. This space will be sufficient until the birds are well enough grown to market and there will be no need to reduce numbers as they grow.

In the intensive system one could start by allowing cockerels of the same age three square feet of floor space in poultry houses built for 100 adults. This is not sufficient for well-grown birds. Cockerels do not all grow at the same rate. The larger birds could be disposed of probably

at 12 to 14 weeks of age, which would leave enough room for the balance. Birds of about 14 weeks of age would require 3½ to 4 square feet according to the breed. In small sheds a greater space per bird should be allowed.

Rate of Development and Food Consumption.

The following tables, giving the average weight of birds at varying ages and the average feed consumption to that age, have been compiled from experiments conducted by this Department. Similar results can be obtained by most people with reasonable care and attention.

Table 1 indicates very definitely that for the economic use of food it is necessary that the ration supplied to the birds from 6 weeks of age contain protein at a level of at least 15 per cent. During the early stages, that is, when the birds are from 6 to 8 or 9 weeks of age, a higher level might be an advantage. From day-old to six weeks a starting mash should be used.

A comparison of Table 1 and Table 2 suggests that there is little advantage, if any, in battery rearing as compared to pen rearing when the food required to produce a pound of poultry is compared. With batteries one can handle greater numbers in a confined area, but the greater the confinement the greater the need for sanitation.

The tables also indicate that, as the birds age, a greater quantity of food is required for each pound gained. Farmers should compare food consumption and development with these tables and calculate from time to time the cost of production.

Feeding.

The nutrients required by young chickens, growing stock and adults have been definitely determined by poultry nutrition authorities.

The most practical approach to the subject, therefore, is to become familiar with the requirements of the different age-groups and the foodstuffs that will supply these nutrients.

In the usual material used for feeding many of the nutrients are not in short supply and for practical purposes it will suffice if only those nutrients that are frequently deficient in rations are considered at present.

TABLE 1.

BATTERY REARED AUSTRALORP COCKERELS.

Table showing the age in weeks and the weight of the birds and the amount of food consumed, using rations with a crude protein content of 13%, 15% and 17%.

Age in Weeks.	13 Per Cent. Protein.		15 Per Cent. Protein.		17 Per Cent. Protein.	
	Weight of Bird.	Weight of Food Consumed. from Day Old.	Weight of Bird	Weight of Food Consumed.	Weight of Bird.	Weight of Food Consumed.
	Lb.	Lb.	Lb.	Lb.	Lb.	Lb.
6	1·35	2·7	1·31	2·7	1·32	2·7
9	1·9	5·9	2·35	5·9	2·45	5·99
12	2·8	9·8	3·2	9·8	3·5	10·2
15	3·45	13·9	4·01	13·9	4·4	14·8

NOTE: In calculating the protein content of the ration all types of food given must be assessed.

TABLE 2.

COCKERELS REARED UNDER HOUSE AND YARD SYSTEM.

Table showing the age in weeks, the weight of the birds and amount of food consumed. In addition, the amount of feed necessary to produce one pound of body weight is also shown. The ration used in the two tests had a crude protein content of 17%.

Age in Weeks.	Average Weight Bird.	Average Food Consumed.	Amount Feed Produce One Pound Body Weight.
	Lb.	Lb.	Lb.
		WHITE LEGHORNS.	
8	1·33	3·42	2·57
10	1·80	5·28	2·93
12	2·16	7·30	3·37
14	2·64	9·29	3·51
16	2·98	11·25	3·57
18	3·19	13·48	4·22
		AUSTRALORPS.	
8	1·71	3·97	2·32
10	2·40	6·22	2·59
12	3·06	8·77	2·86
14	3·76	11·28	3·00
16	4·52	14·13	3·12
18	5·31	17·36	3·26
20	5·85	20·85	3·56
22	6·47	24·00	3·70
24	6·76	26·95	3·98

As mentioned previously, protein is necessary for economical development. At least 20 per cent. of the protein content of a ration should be of animal origin—i.e., protein meals and milk products.

Vitamin A deficiency is not uncommon. The vitamin is short in all rations composed of white grains and even yellow maize cannot supply the full needs. Good green feed is the cheapest source.

Vitamin D deficiency is noted when the birds do not have access to direct sunlight. When they have this, supplemental vitamin D is not required.

TABLE 3.

LEVELS OF SOME ESSENTIAL NUTRIENTS.

Nutrient.	Amount per Pound of Feed.		
	Chickens. Day Old to 8 weeks.	Growing Stock. 8 to 20 weeks.	Layers, Breeders.
Crude Protein—Per cent. ..	18–20	16	15
Vitamin A— Inter. Units..	2,000	2,000	3,300
Vitamin D— A.O.A.C. Units	180	180	450
Riboflavin—mgm.	1,600	Not known	1,250
MINERALS.			
Calcium—Per cent.	1·0	1·0	2·25
Phosphorus—Per cent. ..	·6	·6	·75
Salt—Per cent.	1 to·5	1 to ·5	1 to ·5
Manganese—mgm.	25·0	..	15·0

TABLE 4.

AVERAGE VITAMIN CONTENT OF SOME FEEDSTUFFS.

Kind.	Vitamin A. per lb. Inter. Unit.	Vitamin B1. per lb. Inter. Unit.	Vitamin D. per lb. A O.A.C.	Vitamin E.	Vitamin B2. (Riboflavin) M/grammes per lb.
Barley	400	250	Trace . .	xx	400
Maize (Yellow)	3,180	270	*	xx	450
Maize (White)	0	270	*	xx	450
Cowpeas . .	1,360	450	*	*	400
Milo	250	*	*	*	400
Oats	80	270	*	xx	400
Peanut Meal . .	150	900	*	xx	1,200
Wheat	140	340	*	xx	400
Wheat Bran . .	150	450	*	xx	1,000
Cottonseed Meal	600	1,800	*	*	300
Linseed Meal	200	2,000	*	x	900
Buttermilk, Dried . .	200	400	Trace . .	x	9,000
Cod Liver Oil . .	340,190	0	45,360	0	0
Liver Meal . .	*	*	*	*	18,500
Meat Scrap . .	*	*	*	*	2,700
Green Lucerne	53,560	225	*	xx	2,000
Lucerne Meal . .	13,000	400	*	xxx	5,000
Lucerne Leaf Meal . .	32,000	400	14	xxx	7,000
Pollard . .	120	1,000	*	xxx	900

* Information on vitamin content is lacking.
† No appreciable quantity.
xx Good source.
xxx Very good source.

Riboflavin deficiency is noted on many farms. Milk products and liver meals are the commonest sources for building up the ration with this vitamin. A synthetic product is now available.

Birds having free access to shell-grit are provided with their calcium needs, but, in raising birds for table purposes, ground limestone or shell-grit as an addition to the mash is necessary at the rate of 1 to 2 per cent.

TABLE 5.

AVERAGE MINERAL CONTENT OF SOME FEEDSTUFFS.

Kind.	Calcium.	Phosphorus.	Manganese.
	Per cent.	Per cent.	Parts Per Million.
Barley	·05	·36	16
Maize (Yellow)	·01	·29	5
Milo	·04	·32	15
Oats	·10	·44	20
Wheat	·04	·39	39
Wheat Bran	·11	1·21	119
Wheat Middlings	·08	·93	119
Buttermilk, Dried	1·56	1·05	4
Meat Scrap	8·25	4·00	18
Green Lucerne	·42	0·7	7
Lucerne Meal	1·44	·21	26
Lucerne Leaf Meal	1·90	·22	30

ALL MASH—CHICKENS DAY-OLD TO 6 TO 8 WEEKS.

Ingredient.	Mixtures. 1.	2.	3.	4.
Yellow Maize Meal	38	..	..	20
Wheat Meal	..	43	43	20
Sorghum Meal	..	20	20	25
Bran	20	20	15	10
Pollard	20	..	..	..
Lucerne Meal	..	..	5	5
Protein Meal (55 per cent) ..	9	9	14	12
Buttermilk Powder	10	..	..	5
Liver Meal	..	5	..	..
Ground Limestone or Shell ..	1	1	1	1
Synthetic Riboflavin.. ..	..	..	As directed by vendor	As directed by vendor
Vitaminised Preparation ..	1	1	1	1
Manganese–Salt Mixture* ..	1	1	1	1
	100	100	100	100

* Manganese–salt mixture consists of a mixture of 4 ounces of commercial manganese sulphate and 20 pounds of common salt.

Manganese deficiency occurs where rations are more or less devoid of mill offals. The use of commercial manganese sulphate overcomes the shortage. Excess of either calcium or phosphorus will also reduce the availability of manganese.

Tables 4 and 5 indicate the vitamins and the sources of the essential minerals of foodstuffs commonly used in poultry nutrition. These tables will assist in compiling rations.

ALL MASH—GROWING BIRDS 8 TO 20 WEEKS.

BIRDS HAVING ACCESS TO DIRECT SUNLIGHT.

Ingredient.	Ration. 1.	2.	3.	4.
Maize Meal	35	..	..	..
Wheatmeal ..	30	40	51	66
Sorghum Meal	..	22	12	..
Bran	10	10	..	20
Pollard	20	10	20	..
Lucerne Chaff (Leafy) ..	4	4	6	4
Protein Meal	5	8	9	6
Ground Limestone or Shell ..	1	1	1	1
Manganese–Salt Mixture ..	1	1	1	1
Liver Meal	4	..	..	2
Milk Powder	..	4	..	2
Synthetic Riboflavin.. ..	..	..	As directed by Vendor	..

Suggested Rations.

The all-mash method of feeding is recommended in producing table poultry and suitable mixtures are suggested here.

No special fattening process is suggested. Young birds that have received suitable rations should at all stages be well fleshed. Any gains in weight that might follow any special fattening process are due to an increase in growth.

Crushed grains, owing to the shortage of mill offal, will have to form the bulk of rations. Grains should not be finely ground. Better development is associated with mixtures of a granular nature.

If a good succulent green feed is not available to be fed in conjunction with these mashes a vitamin A preparation should be used as a supplement.

Owing to the impossibility of obtaining a wide range of ingredients, mixtures have to be very simple. Where bran is not available a good sample of crushed whole oats would make a useful addition. Oats of good quality are a valuable food. They have been omitted as they are not usually available.

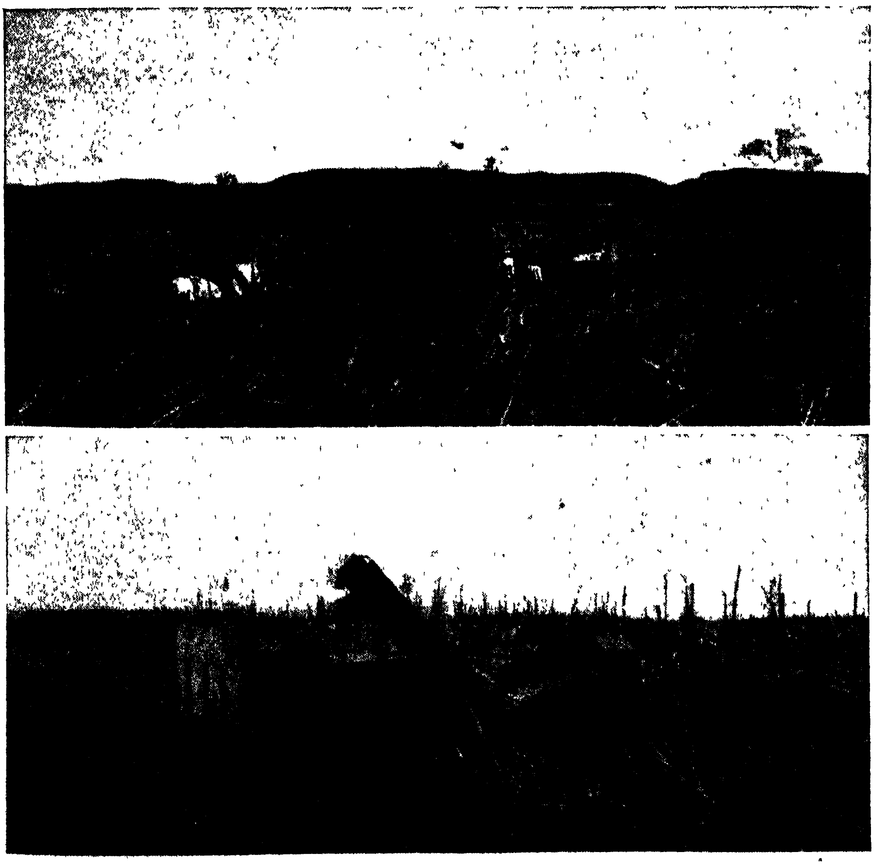


Plate 51.

THE OLD AND THE NEW IN MAIZE HARVESTING ON THE ATHERTON TABLELAND.

Junior Farmer Clubs.

THE opening of the year saw new Junior Farmer Clubs established at Murgon, Helidon, Bauple, and Goomboorian, while others ready but awaiting the visit of the State Director of the organisation (Mr. T. L. Williams) included Killarney, Allora, and Tiaro.

The three clubs in the Callide Valley area (Biloela, Mount Murchison, and Thangool) meet regularly at Biloela, but it is expected that at a later date these will operate separately, as membership has grown at each centre.

Nominations called for the Australian Broadcasting Commission's grand championship competition for junior farmers for 1949, to be conducted at the Sydney Royal Show next Easter, brought forth quite a number of applications from members of the organisation in Queensland. These members will undergo a preliminary test in Brisbane in March, when this State's representative will be selected. Added interest is attached to this year's competition by reason of the fact that the champion junior farmer from New Zealand has been invited to participate in the contest, in open competition with Australia's best junior farmers drawn from each State.

Following a suggestion made to them some time ago by the Director, several recently-formed clubs in country areas have adopted the title of "Agricultural and Social Clubs," the reason given being that members can be expected to band together better when their activities are such that they cover both agricultural study and social aspects.

As "all work and no play" is just as applicable to the junior farmer movement as in other directions, Mr. Williams is encouraging most centres to use such a title. Not only will it give greater opportunities for these young men and women to work together as agricultural "study groups," but it will afford them an opportunity of improving the local community themselves or work in conjunction with other recognised public bodies, each body concerned sharing expenses and, of course, profits. By this means, he added, initiative of purpose, team spirit and work and the creation of ideas in the running of various forms of public functions will be developed in the minds of these young men and women, at the same time enabling them to build up a small cash fund from which can be met library and minor expenses.

ASTRONOMICAL DATA FOR QUEENSLAND.

APRIL, 1949.

Supplied by W. J. Newell, Hon. Secretary of the Astronomical Society of Queensland.

TIMES OF SUNRISE AND SUNSET.

At Brisbane.			MINUTES LATER THAN BRISBANE AT OTHER PLACES.					
Day.	Rise.	Set.	Place.	Rise.	Set.	Place.	Rise.	Set.
	a.m.	p.m.						
1	5.57	5.47	Cairns	20	38	Longreach	31	39
6	6.00	5.41	Charleville ..	26	28	Quilpie	36	34
11	6 02	5.36	Cloncurry	44	56	Rockhampton ..	6	14
16	6.05	5.30	Cunnamulla ..	30	28	Roma	16	18
21	6.08	5.26	Dirranbandi ..	20	18	Townsville ..	18	33
26	6.10	5.21	Emerald	15	23	Winton	35	45
30	6.12	5.18	Hughenden ..	29	41	Warwick	5	3

TIMES OF MOONRISE AND MOONSET.

At Brisbane.

Day.	Rise.	Set.
	a.m.	p.m.
1	7.56	7.08
2	8.52	7.42
3	9 49	8.22
4	10.48	9 07
5	11.48	10.00
	p.m.	
6	12·45	11.00
7	1.38	..
		a.m.
8	2.26	12.05
9	3.10	1.12
10	3.49	2.20
11	4.25	3.28
12	5.01	4.36
13	5.37	5.44
14	6.16	6.53
15	6.59	8.02
16	7.46	9.12
17	8.39	10.19
18	9.37	11.21
		p.m.
19	10.36	12.17
20	11·35	1.04
21	..	1.45
	a m.	
22	12.33	2.20
23	1.29	2.51
24	2.22	3.19
25	3·14	3.46
26	4.05	4.13
27	4.57	4.41
28	5.51	5.10
29	6.46	5.43
30	7.43	6.22

MINUTES LATER THAN BRISBANE (SOUTHERN DISTRICTS).

Charleville 27; Cunnamulla 29; Dirranbandi 19;
Quilpie 35; Roma 17; Warwick 4.

MINUTES LATER THAN BRISBANE (CENTRAL DISTRICTS).

Day.	Emerald.		Longreach.		Rockhampton.		Winton.	
	Rise.	Set.	Rise.	Set.	Rise.	Set.	Rise.	Set.
1	14	25	29	41	4	17	33	49
6	9	30	25	45	0	21	26	54
11	17	23	33	39	8	14	37	44
16	30	11	45	25	20	0	53	52
21	27	12	43	26	18	1	50	29
26	19	20	35	37	10	11	39	42
30	12	29	27	44	1	19	29	52

MINUTES LATER THAN BRISBANE (NORTHERN DISTRICTS).

Day.	Cairns.		Cloncurry.		Hughenden.		Townsville.	
	Rise.	Set.	Rise.	Set.	Rise.	Set.	Rise.	Set.
1	17	44	41	60	26	46	15	37
3	8	52	36	65	21	50	8	44
5	2	56	33	67	17	53	3	46
7	5	52	35	65	19	50	5	44
9	13	48	39	62	24	48	12	40
11	25	37	47	56	32	41	21	32
13	38	24	56	46	41	31	32	21
15	50	11	64	38	48	23	41	11
17	56	3	68	32	52	18	46	4
19	55	2	68	32	51	17	45	3
21	47	8	63	36	47	21	39	8
23	43	17	60	42	45	27	36	16
25	34	27	53	48	38	33	28	23
27	23	37	46	56	30	41	20	32
30	9	51	37	64	21	50	8	43

Phases of the Moon.—First Quarter, 6th April, 11.01 p.m.; Full Moon, 13th April, 2.08 p.m.; Last Quarter, 20th April, 1.27 p.m., New Moon, 28th April, 6.02 p.m.

On 15th April, the Sun will rise and set 12 degrees north of true east and true west respectively, and on 12th and 26th April the Moon will rise and set approximately at true east and west respectively.

Eclipses.—On 13th April there will be a total eclipse of the Moon, but it will not be visible from Australia; and also on 28th April the partial eclipse of the Sun will not be visible from Australia, the limits of the eclipse area being confined to the Northern Hemisphere.

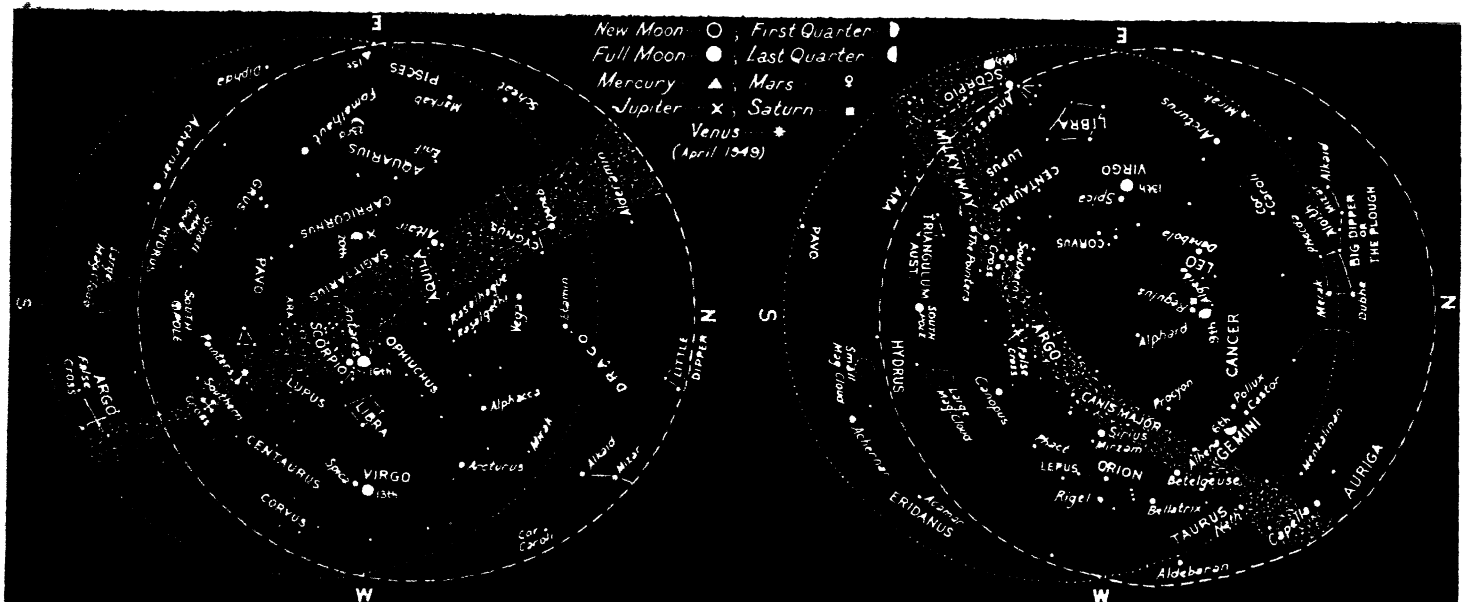
Mercury.—A morning object, in the constellation of Pisces at the beginning of the month when it will rise nearly one hour before the Sun. On the 13th it will be in line with the Sun after which it will become an evening object, and on the 30th, in the constellation of Taurus, will set nearly an hour after the Sun.

Venus.—Too close in line with the Sun for observation, being in Superior conjunction with the Sun on the 16th.

Mars.—Now rising before the Sun but still rather close to the Sun for observation. By the 30th it will rise only 45 minutes before the Sun.

Jupiter.—In the constellation of Sagittarius, will rise about mid-day at the beginning of April and between 10.45 p.m. and 11.45 p.m. at the end of the month.

Saturn.—On the 11th, in the constellation of Leo, just to the east of Regulus, will rise during the afternoon and will set about 3 hours after midnight. By the 30th it will set about one hour after midnight.



Star Charts.—The chart on the right is for 8.15 p.m. in the south-east corner of Queensland to 9.15 p.m. along the Northern Territory border on the 15th April. (For every degree of longitude we go west the time increases by 4 minutes.) The chart on the left is for 8 hours later. On each chart the dashed circle is the horizon as viewed from Cape York and the dotted circle is the horizon for places along the New South Wales border. When facing north hold "N" at the bottom; when facing south hold "S" at the bottom and similarly for the other directions. Only the brightest stars are included and the more conspicuous constellations named. The stars which do not change their relation to one another, moving east to west, arrive at any selected position about 4 minutes earlier each night. Thus, at the beginning of the month the stars will be in the positions shown about 1 hour later than the time stated for the 15th and at the end of the month about 1 hour earlier than that time. The positions of the Moon and planets, which are continually changing in relation to the stars are shown for certain marked days. When no date is marked the position is for the middle of the month.

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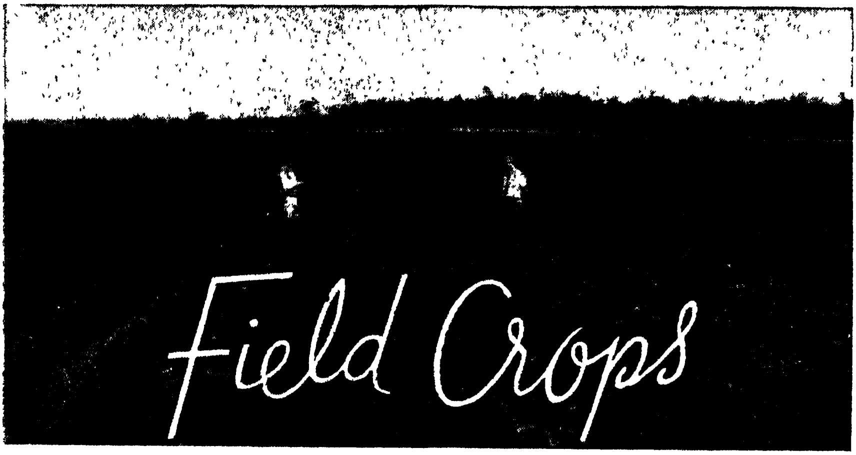
Contents



Onion Growing in Queensland.

W. G. FERGUSON, Adviser in Agriculture, Agriculture Branch.

ONION growing is not a major primary industry in Queensland, but is of particular importance in some districts. For the five-year period ending in 1947, the average annual acreage was approximately 2,000.

Although onions could be grown in many districts in Queensland, production at present is confined almost entirely to the south-eastern corner of the State, and particularly the Lockyer Valley, where soil, climate and irrigation facilities make the onion a profitable farm crop.

Suitable Soils.

The onion plant thrives in fertile, friable soils of light to medium texture (loams and sandy loams), of good depth and good moisture-retaining properties. The plant is not tolerant of soil acidity and grows best in soils of neutral or only slightly acid reaction. Heavy soils such as clay loams produce a bulb with a firm skin and satisfactory keeping qualities, but with favourable growing conditions onions on these soils tend to form abnormally thick necks popularly known as "bull necks" or "bottle necks." Onions of this type (Plate 52) are not desired by the market.

Sandy soils which require the addition of heavy applications of organic matter to maintain tilth are not suitable for onions. Such soils need regular and frequent rainfall or irrigation to avoid growth checks.

Rotations.

Since the main cultural problem in onion growing is weeding, it is a common practice to grow onions for several years on the same piece of land. Though this does help to overcome the weed problem the practice is often overdone and rotations with other crops should be adopted.

Onions can be grown successfully after most crops but do better following lucerne and potatoes. They respond particularly well following a legume, such as cowpea, grown as a green manure.

Plate 52.

"BULL NECK" OR "BOTTLE NECK" BULBS.—The centre bulb is a good market type of onion. Poor seed and excessive irrigation on fertile heavy soils may tend to produce "bull necks."

Preparation of the Seed-bed.

Too much emphasis cannot be placed on the careful working of the soil. Thorough preparation not only means a good seed-bed but also reduces the risk of serious weed infestation in the growing crop.

The initial ploughing is usually made in November to a depth of about eight inches, and the land is then worked lightly to avoid soil moisture loss and at the same time provide good conditions for the absorption of rain. Normally one ploughing suffices, but in the case of newly broken-up lucerne land, or land in which the risk of a serious weed problem is known to be great, two ploughings will be necessary, the first of which should be made 12 months before the onions are due to be planted. Subsequent cultivation is aimed at eliminating weeds before they seed and preparing a seed-bed of desired fineness and condition. The final operation before planting will entail the use of harrows with or without the roller or sledge board, as soil conditions demand.

Before planting, the seed-bed should be completely free of weeds, about two to three inches in depth, and have a surface tilth of market garden fineness. The sub-surface soil should be moist and firm, but not too compact, for the onion is a fairly deep rooting plant.

Planting.

The onion is a biennial, requiring cool weather early in the growing season and dry weather with moderately high temperatures later. The normal time for planting in the Lockyer Valley is in May, but field selection of early-maturing bulbs over many years by local farmers has produced non-bolting strains which may be planted with safety in early April. These extra-early maturing strains play an important part in meeting market requirements in late August, September and October. It is emphasised that the use of reliable seed is an important factor in profitable onion production.

Plate 53.

TOO EARLY PLANTING.—The crop on the left was planted very early and has developed seed stems.

Too early planting of seed produces bulbs with seed stems (Plates 53 and 54), while on the other hand planting too late allows insufficient time for the bulbs to mature before hot weather, when the risk of bulb scald is high.

In the Lockyer Valley, the seed is sown in drills in the field. The transplanting of seedling onions from seed-beds is laborious, and is not practised by commercial growers under present-day conditions.

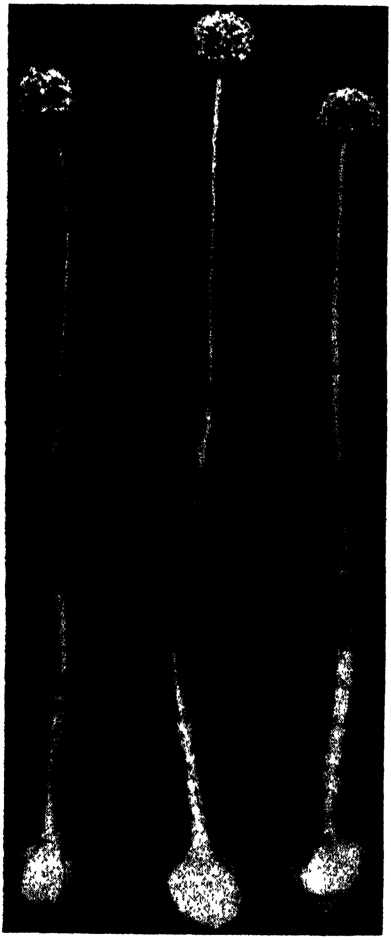


Plate 54.
ONION BULBS WITH SEED STEMS.—Such bulbs should not be marketed.

The seed is sown at a depth of approximately one inch in drills 12 to 15 inches apart, and at a rate of $1\frac{1}{4}$ to $1\frac{3}{4}$ lb. per acre. This sowing rate gives an adequate stand (Plate 55) and at the same time eliminates the labour of hand thinning. Drills less than 12 inches apart do not allow sufficient room for inter-row cultivation; row spacings wider than 15 inches mean unnecessary waste of land.

Planting is done with either the single-row hand sowing machine or the motor-driven garden-cultivator, which plants and cultivates three rows at a time. In all machines, it is necessary to reduce the seeding rate set by manufacturers as this usually gives a rate of 3 lb. per acre. An approximate seeding rate per yard of row length, with the rate recommended per acre, is 24 to 28 seeds.

Normal plant spacing for irrigated crops is three inches. Less than this results in malformation of bulbs and favours the spread of disease, while wider spacing tends to produce an onion too large for prime market requirements. Rain-grown crops do not produce reasonably-sized bulbs, except under unusually favourable conditions, unless spaced four to six inches.

Varieties.

The globe types are preferred in Queensland because the flat onion is prone to rots and other diseases around the base under summer conditions. Locally selected strains of Early Hunter River Brown Spanish are used for April plantings, with Brown Spanish as the main crop variety planted in the May to June period. Hunter River Early White Globe is the white variety which gives best results and strains of this variety are normally planted in May.

Cultivation.

Keeping the rows and inter-row spaces free of weeds can be a tedious and costly operation. Normally, weeding does not call for excessive labour and time, provided the seed-bed has been efficiently prepared to eliminate weeds.

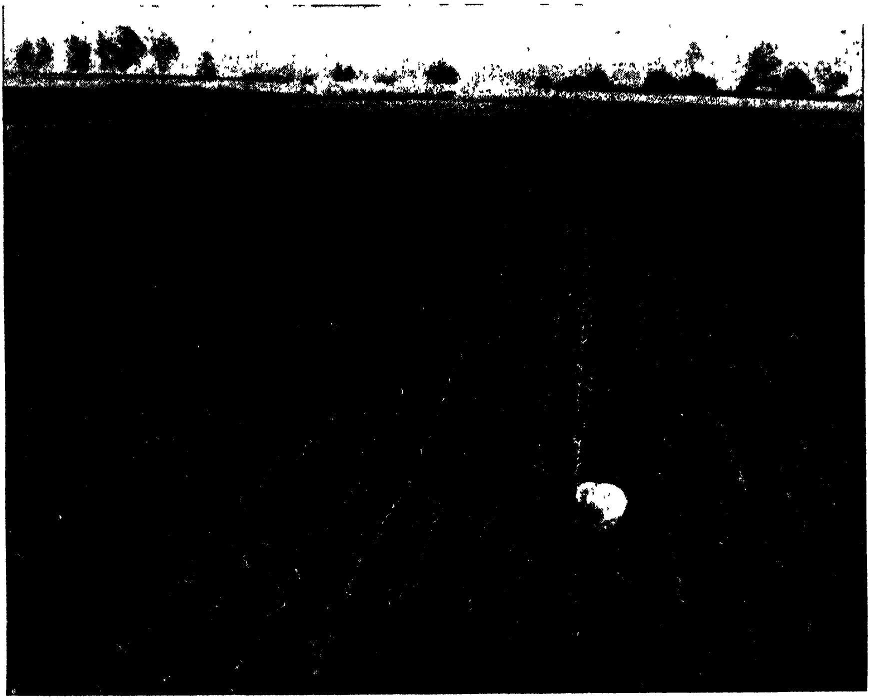


Plate 55.

A FIELD OF YOUNG ONIONS COMMENCING TO BULB.

Inter-row cultivation is best done with the wheel hoe or garden tractor equipped with appropriate weeders. In addition to weed control, an important consideration is the drawing away of soil from the plants, as any hilling restricts bulb growth. Weeds in the rows themselves are removed with a two-inch garden hoe. Selective weedicides, such as sulphuric acid and dinitro types, which do competent work at a comparatively low cost, are a useful supplementary method of weed control especially where weed growth along the rows is heavy.

Irrigation.

On irrigable areas of south-eastern Queensland the onion is fast finding a permanent place in the farm crop programme. In general, the water requirements of the onion are light in the early stages of growth and heavier as the crop matures. The spray systems are the only form of irrigation used in Queensland.

Normal procedure is to dry-plant the seed and then apply sufficient irrigation for germination, which usually takes 9-11 days. This application is not heavy and varies from 20 to 50 points.

If insufficient rain falls after the seedlings are established, a second light irrigation will be necessary. Subsequent waterings will depend upon the type and condition of the soil. It must be emphasised, however, that excessive irrigation will produce "bull necks" and scallions (Plate 56), delay ripening, favour diseases and produce an onion of poor keeping quality. The recommended procedure is to withhold heavy irrigation until the bulb is fairly forward, in order to promote root and bulb formation, and then apply an irrigation of about two inches. This should suffice to carry the crop through to harvesting.

Plate 56.

SCALLIONS COMPARED WITH A GOOD MARKET TYPE OF ONION.—Scallions commonly develop on heavy fertile soils which are irrigated excessively.

Harvesting.

A period of five to six months elapses from the time of planting to the date at which the onion reaches maturity. The mature stage is indicated by the shrivelling of the stalk immediately above the bulb and by the stalk subsequently falling over, yellowing and dying.

Harvesting commences at the yellowing stage, the plants being pulled and laid in windrows. Where garden tractors are available, it is customary to attach a cutting implement to the tool bar and under-cut the roots to facilitate pulling. In the Lockyer Valley, the bulbs are usually trimmed in the field, that is, the remaining roots are clipped close to the base and the neck cut about one-half to one inch above the bulb

with sheep shears. The bulbs are then bagged in the field into open-mesh bags (Plate 57) and either stored in the barn or marketed. A better article can be marketed, however, if the bulbs are allowed to cure in the field before they are trimmed and bagged.

An average yield for irrigated onions is seven tons to the acre, but yields of up to 10 tons per acre are not uncommon. Yields from non-irrigated onions vary markedly according to the season, but in some years may be little inferior to irrigated crops.

Plate 57.

HARVESTING AND GRADING ONIONS IN THE LOCKYER VALLEY.

Grading and Marketing.

Better prices are received when the bulbs are graded into size according to popular demand, bearing in mind that moderate-sized onions are in greater demand than larger ones. In pursuance of the provisions of *The Fruit and Vegetables Act of* 1947 the following regulation was gazetted on September 9th, 1948, to cover the grading and marketing of onions in Queensland:—

> "No person shall sell or offer for sale any onions contained in a package unless, in addition to compliance with the general requirements of these Regulations, the onions have been graded into one or other of three grades, viz:—
>
> "First Quality Large"; "First Quality Table"; or "Picklers," and have been graded as to size and quality, and packed in accordance with the following provisions:—
>
> (*a*) The package shall be marked with a true designation of the grade, whether "First Quality Large," "First Quality Table" or "Picklers," of the onions contained in the package;

(*b*) Each external layer of onions on the top, bottom and sides of the onions, whether described as "First Quality Large," "First Quality Table" or "Picklers," shall be a true indication of the average grade of the onions throughout the package;

(*c*) Onions described as "First Quality Large" shall consist of sound, clean, well-cured onions of similar varietal characteristics, free from abnormal doubles, pipers, bottle necks, scallions, sprouts, root growths, disease, mechanical injuries, dirt or other foreign matter, and reasonably free from peeled onions. Not less than ninety per centum of the total of the individual onions in each package shall be two (2) inches or over in diameter and the individual onions in the remaining percentage of the total shall be not less than one and three-quarters ($1\frac{3}{4}$) inches in diameter;

(*d*) Onions described as "First Quality Table" shall consist of sound, clean, well cured onions of similar varietal characteristics, free from abnormal doubles, pipers, bottle necks, scallions, sprouts, root growths, mechanical injuries, dirt or other foreign matter, and reasonably free from peeled onions. Not less than seventy-five per centum of the total of the individual onions in each package shall be one and five-eighths ($1\frac{5}{8}$) inches or over in diameter and the individual onions in the remaining percentage of the total shall be not less than one and one-half ($1\frac{1}{2}$) inches in diameter;

(*e*) Onions described as "Picklers" shall consist of sound, clean onions, one and one-half ($1\frac{1}{2}$) inches or less in diameter.

Every package shall be legibly and durably stamped or stencilled on a prominent part of the outside of the package with the initials of the christian names and the full surname and the address of the packer and the grade in letters not less than three-quarters ($\frac{3}{4}$) of an inch in height, except that where open mesh onion bags are used such bags shall be deemed to be marked if tags showing the above particulars are securely fixed to the bags.

Definitions.

In this Regulation unless the context otherwise indicates the following terms have the meanings respectively assigned to them:—

"Doubles" in relation to onions means that an onion has more than one distinct bulb visible externally.

"Pipers" in relation to onions means the possession of a weak or hollow centre, or onions which have developed seed stems.

"Bottle Necks" in relation to onions means the possession of abnormally thick necks.

"Scallions" in relation to onions means the possession of thick necks on poorly developed bulbs.

"Peeled" in relation to onions means onions from which the outer skin has been removed."

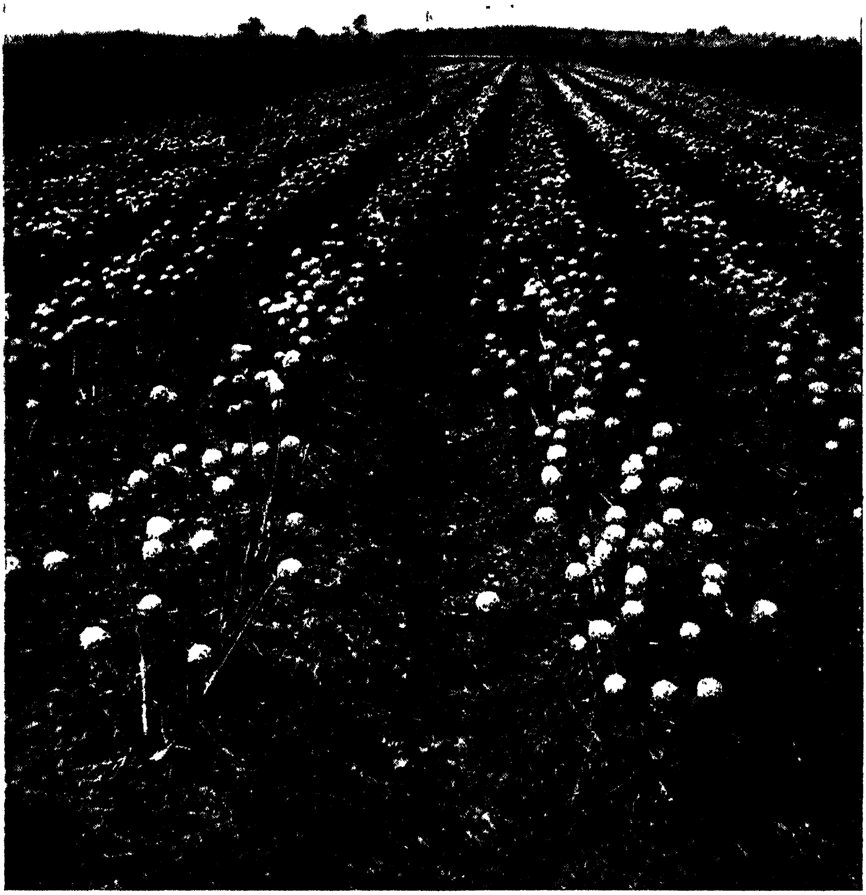


Plate 58.
An Onion Seed Plot in the Lockyer Valley.

Seed Production.

An essential requirement for good quality onions is the use of seed produced by bulbs specially selected in the field. Selection is made prior to harvest and is restricted to bulbs ripening at the desired time of harvest which are true to type with a slim neck of good length and show no malformation or symptoms of disease. These selections are placed in racks in a cool dry place away from direct light. The bulbs are inspected at intervals and any rotted, early sprouting or double bulbs are removed.

In the period May to June, the bulbs are planted about two feet apart with three to four feet between rows (Plate 58). Where irrigation is available, it is advisable to furrow irrigate rather than spray, as spraying favours the development of downy mildew, a fungus disease

which is harmful even in mild attacks. From the planted bulbs, numerous bulbils form, each of which sends up a shoot from which the flower sack arises. The sack bursts, the flowers open, and eventually seed is formed.

Seed heads are normally harvested in November. The procedure is to clip the seed stem about 12 inches below the head. The heads and attached stems are then placed in chaff bags and hung in a cool, well ventilated place and allowed to dry out. Before threshing, the head is clipped from the stem just above the stem button. After threshing, the seed is winnowed and thoroughly cleaned. A final cleaning and a rough viability test are given by immersion in water; the floating seed and trash are skimmed off leaving sound seed on the bottom. The seed is washed once or twice more, then dried thoroughly and bagged.

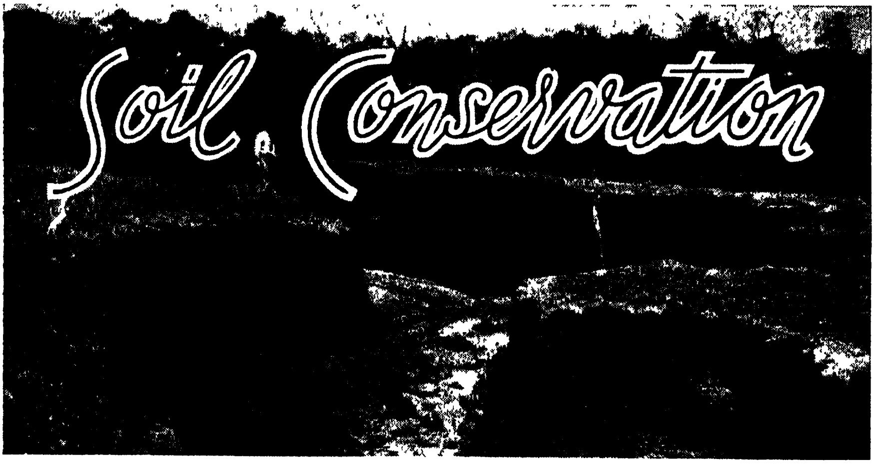
It is not advisable to keep onion seed for more than 12 months as it deteriorates rapidly. Seed 12 or more months old should always be given a germination test before planting to assess whether the normal planting rate should be increased. Germination tests can be carried out simply by placing a known number of seeds between two sheets of blotting paper kept moist in a fairly warm place and calculating germination percentage from the number of sprouted seeds.

Onion Diseases and Pests.*

Onion crops are normally grown in Queensland with little if any attention to the control of disease. The most serious disease of the onion plant, namely onion smut, is not present in this country and every endeavour is being made by quarantine authorities to keep it out. Another disease, downy mildew, is well established here. It is caused by a fungus which produces purplish-grey blotches on the leaves and, in the seed crop, on the stems of onion plants. At times the loss of leaf tissue becomes serious and a reduction of crop results. This occurs only when conditions are favourable to the disease, that is, during and after a cool, damp spell. At such times, applications of a copper spray with the addition of spreader should be made at intervals of 10 to 14 days.

The only serious insect pest of onions is the onion thrips. This is a very small, slender, straw-coloured insect that infests quite a number of plants and is notably capable of causing serious damage on onions. The foliage of the plant may be heavily infested and affected leaves will become blotched or streaked, finally withering back from the tip. The whole plant may present an unthrifty appearance and the resultant onion bulb will be markedly reduced in size. If onions are grown for seed the thrips will ascend the flower stalk and may cause flower "blasting," preventing seed production. The control of onion thrips depends on preventing the development of large populations on the plants. The most satisfactory treatment is to apply a spray prepared from a DDT emulsion to give a spray strength of 0·1 per cent. DDT. This should be applied at least fortnightly throughout the life of the plants.

* Notes supplied by R. B. Morwood (Senior Pathologist) and J. A. Weddell (Assistant Senior Entomologist).



Building Contour Banks with a Plough by the Island Method.

J. E. LADEWIG, Senior Soil Conservationist.

THE correct use of land, in accordance with its capability, is the basic principle of conservation farming, and only level to moderately sloping land should be utilised for cultivation; the maintenance of the soil in a satisfactory condition of structure and fertility will be achieved by the retention and utilisation of all crop residues, the adoption of contour cultivation procedures, and the institution of correct rotational practices on the land. Correct land use reduces the wasteful loss of soil and water, and establishes the basis for permanent agriculture.

However, under Queensland's climatic conditions, the land periodically receives falls of rain which exceed the absorptive capacity of the soil, and occasionally, even that of soils which have been worked under the best possible conditions of land management. On land which has already suffered the ravages of soil erosion, absorption rates are reduced because of loss of top-soil, and run-off water readily congregates in the existing eroded drainage lines.

CONTOUR BANKS.

In order to prevent this run-off water gaining momentum as it races down the slope, it is necessary to construct contour banks across the slope to intercept the water and transfer it from the field at low velocities. Care in the design of these banks is a necessity to ensure that water from them is disposed into stabilised drainage lines, that the banks are correctly spaced, and that they possess a gradient sufficient to avoid overtopping in heavy storms, but with just enough gradient to transport the run-off at low velocities.

Officers of the Department of Agriculture and Stock will design contour banks as an integral part of a soil conservation farm plan, will advise concerning methods to be adopted in the surveying of lines for these banks, and will make recommendations concerning methods of construction.

Building the Bank.

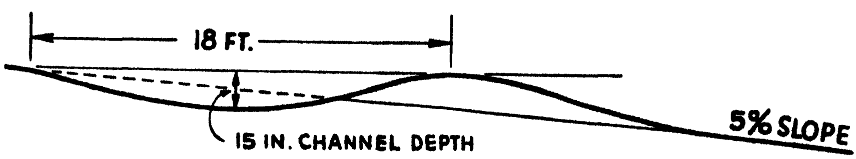
The construction of contour banks frequently presents problems due to the unavailability of suitable earth moving equipment; usually the use of heavy equipment for the construction of banks has proved too costly in operation to justify its extensive use. The use of ploughs for this purpose has proved quite satisfactory, and the United States Soil Conservation Service has developed a system of construction known as the "Island System"—so called because the procedure starts with an island of unploughed soil, on which the contour bank is built. The method is well illustrated in the J. I. Case booklet, "Moldboard Plow Terraces by the Island Method," from which, by courtesy of the J. I. Case Co. and G. E. Holroyde Ltd., the accompanying illustrations have been reproduced.

Plate 59.

A COMPLETED CONTOUR BANK BUILT ON THE ISLAND SYSTEM.

Plate 59 shows a finished contour bank which has been constructed with a two-furrow mouldboard plough. Pictured and described on the following pages is the round-by-round procedure followed in its construction.

The ideal contour bank should be sufficiently wide to enable farm machinery to be operated along its sides, and the channel should be of a depth and width which will ensure conveyance of the maximum amount of run-off water. The following diagram shows suitable dimensions for a bank constructed on a 5 per cent. slope.



Because of the large volume of soil that must be moved, it is important that the plough have ample clearance between beam and share point and between plough bottoms. To avoid difficulty in ploughing operations, heavy surface stubble should be raked aside before starting to plough.

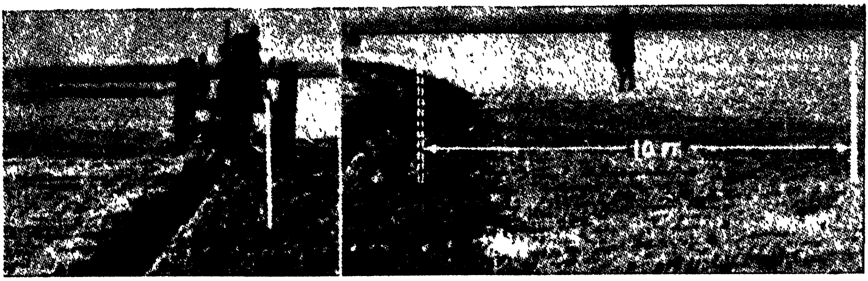


Plate 60.
MAKING THE FIRST ROUND (AT LEFT), AND MARKING A LINE FOR THE RETURN TRIP (RIGHT).

Plate 61.
COMPLETING THE FIRST ROUND.

First Three Rounds.

The first trip of the plough (Plate 60) is made just above and along the line of stakes which have previously been placed, during the survey, to establish the grade line of the contour bank. When the bank is completed this stake line will represent a point about half-way up the top side of the bank.

When the far end of the bank has been reached, the stakes are moved downhill to mark the width of a uniform island, illustrated at the right in Plate 60; the width of island varies according to slope and width of bank desired, as is indicated in Table 1. A modification of the above method of marking a line for the return trip may be adopted, if an implement of the appropriate width is utilised, the bottom edge of the line marked by that implement becoming the guide line for the return trip.

TABLE 1.
SUGGESTED ISLAND WIDTHS FOR DIFFERENT SLOPES.

Slope.	Island Width.
3 per cent. or under	12 ft.
4 per cent.	11 ft.
5 per cent.	10 ft.
6 per cent.	9 ft.
7 per cent. or over	8 ft.

Plate 61 shows the first round in the building of a bank where the marking out on the return trip is almost completed.

Two complete rounds now follow so that at the commencement of Round 4 six furrows have been turned downhill on the top side and six furrows uphill on the lower side of the island.

Rolling Soil on to Upper Side of Island.

After making three rounds, the plough is operated on the upper side, as shown in Plate 62, to roll the soil on to the island. This is the first of the second series of six furrows (3 rounds) on the channel side (left). The plough is advanced 8 to 12 inches closer in on the island to commence this round. Rounds 4 (Plate 62), 7 (Plate 64), 10 (Plate 65), 13 (Plate 66), 16, &c., each advance the loose soil 8 to 12 inches closer in on the island; the smaller the advance the greater will be the depth of loose soil which forms the bank. On the lower side ploughing is continued out in the normal way for a further three rounds.

The channel begins to form as the dead furrow widens on the upper (left) side. The first trips of Rounds 3, 6 (Plate 63), 9, 12, 15 (Plate 67), &c., are made with the rear plough bottom set shallow (on slopes of less than 6 per cent.) to avoid cutting too deep a channel; steeper slopes require deeper ploughing.

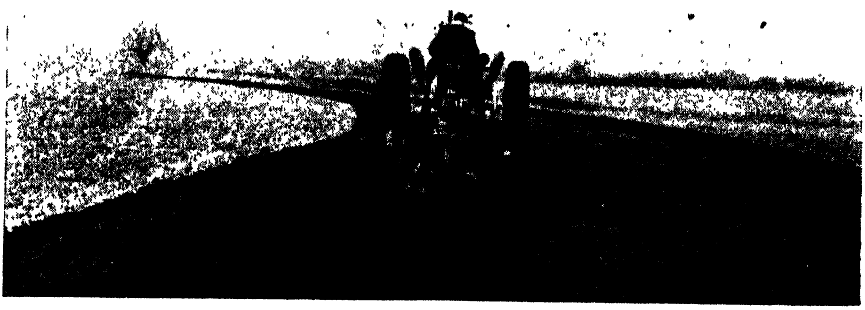


Plate 62.
ROLLING THE SOIL ON TO THE ISLAND ON THE FOURTH ROUND.

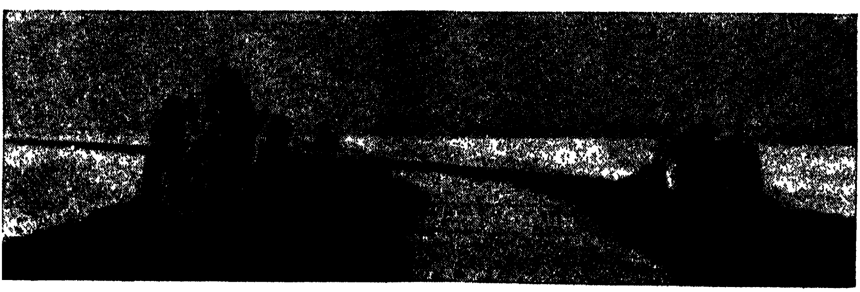


Plate 63.
ON THE SIXTH ROUND.

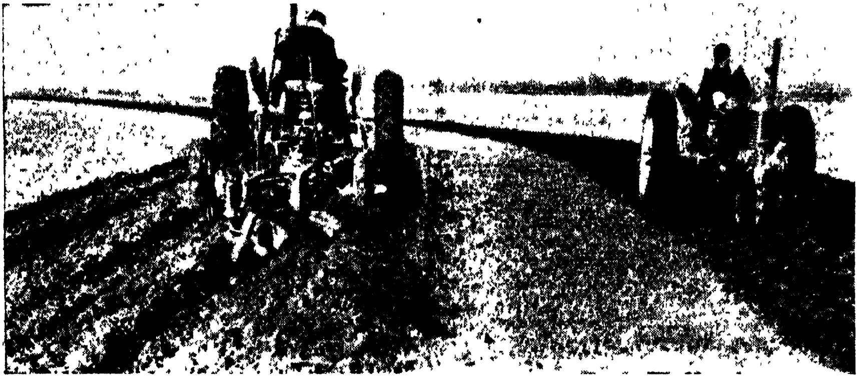


Plate 64.
STARTING TO THROW ON TO THE LOWER SIDE OF THE ISLAND (SEVENTH ROUND).

Plate 65.
ON ROUND 10, STILL THROWING THE SOIL ON TO THE ISLAND.

Plate 66.
ON ROUND 13.

Plate 67.

ON ROUND 15. NOTE THE DEPTH OF LOOSE SOIL ON THE ISLAND.

Plate 68.

ON ROUND 18. THE STAKE IS ON THE ORIGINAL SURVEY LINE.

Plate 69.
ON ROUND 19.

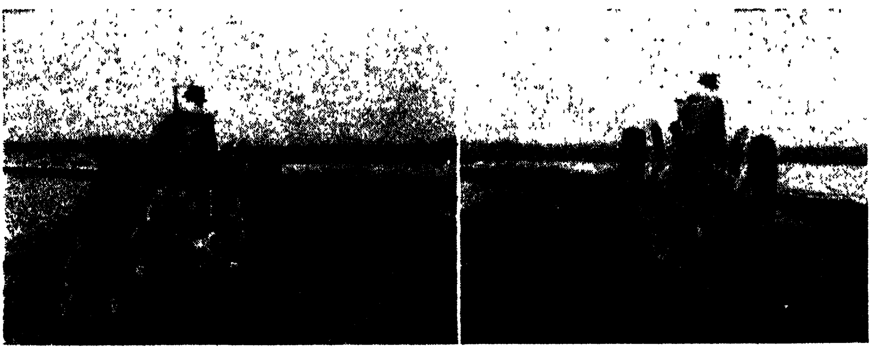


Plate 70.
LEFT, ROUND 21. RIGHT, ROUND 22.

Rolling Soil on to Lower Side of Island.

Return trips of the plough form the lower side of the bank and are made in a series of 12-furrow (6 round) operations. Rounds 7 (Plate 64), 13 (Plate 66), 19 (Plate 69), &c., repeat the start of the series at the lower edge of the island; on slopes of less than 3 per cent. the plough is stepped in 6 inches on to the island on the 7th, 13th and 19th rounds; on 5 per cent. slopes it is stepped in 4 inches, whilst on slopes of 7 per cent. or over no "step-in" is allowed.

On a slope as steep as this (5 per cent.), the movement of soil uphill on the return trip of rounds 7, 13, 19, &c., is approximately 4 inches. The objective is principally to have the "waves" of soil from the upper and lower sides at almost equal depth when they meet on the island.

Working across the Island.

Careful driving maintains a uniform width on the diminishing island, up to the last round. The smaller the advance made on each series of rounds, the greater will be the depth of loose soil which forms the contour bank. Eventually, the wave of loose soil becomes so deep

that, on the first round or two of each series, the plough no longer cuts into the hard ground of the island, but operates entirely to move loose soil inward.

Plate 67 shows Round 15 and Plate 68 Round 18. In Plate 68 the stake marks the position of the original surveyed line.

Plate 69 pictures the first round of the 7th series on the channel side, and the first round of the 4th series on the return trips below the ridge. This is Round 19.

Rounds 21 (left) and 22 (right) are shown in Plate 70. By Round 24 (Plate 71), the island has almost disappeared; with an 8 ft. island 24 rounds would have completed the bank on this slope, but channel capacity would not have been adequate.

Plate 72 shows the outfit operating on Round 25 at maximum ploughing depth to move the greatest possible amount of soil. The return trip continues to raise the ground level to form the lower part of the bank. Round 28 is shown in Plate 73.

Plate 71.

ON ROUND 24, WITH THE ISLAND ALMOST DISAPPEARED.

Plate 72.

PLOUGHING DEEPLY ON ROUND 25.

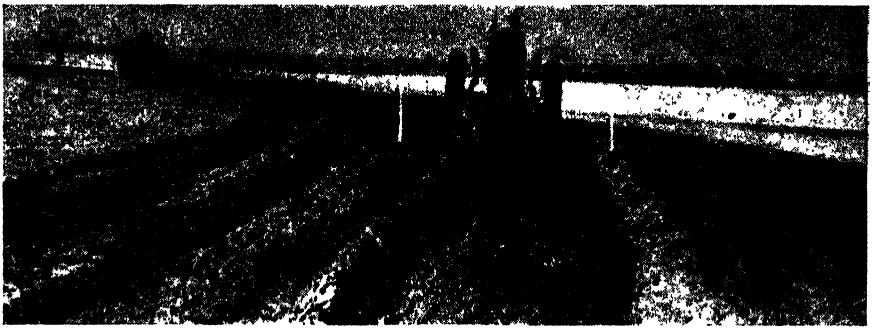


Plate 73.
ON ROUND 28.

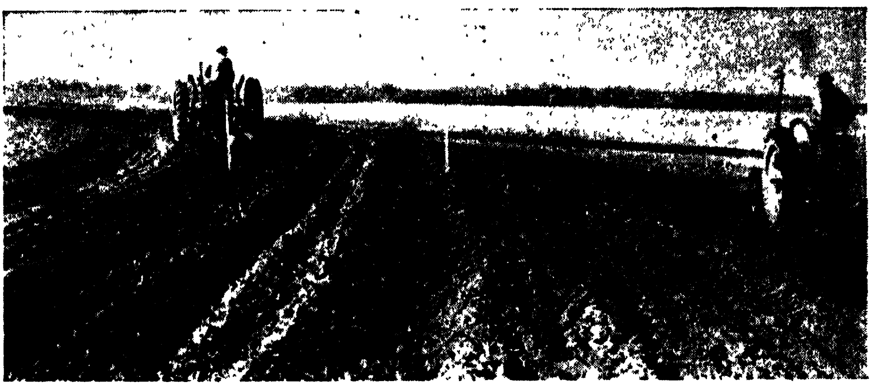


Plate 74.
THE BANK COMPLETED ON ROUND 30.

Completing the Bank.

Under favourable ploughing and moisture conditions Round 30 (Plate 74) should complete this contour bank. Original stake lines are indicated in the photograph.

As shown in Plate 75, the "going" trips of rounds 31, 32 and 33 complete the movement of the upper "wave" of soil to a point where it overlaps with the lower "wave." The return trips of these rounds are used to good advantage in filling the depression at the lower base of the ridge. After these trips the disturbed area below the lower stake (right) is 18 furrows wide.

Plate 76 shows the completed contour bank, which is of the desirable dimensions, with a broad-base bank on which weed control is facilitated, and possessing a channel of adequate capacity.

Diagram of Operations.

The procedure and approximate number of rounds required to construct a contour bank on a 5 per cent. slope, using a 9-ft. island, are shown in Plate 77, and indicate the whole series of operations used in the construction of the bank.

Plate 75.
OVERLAPPING THE THROWN SOIL ON THE ISLAND.

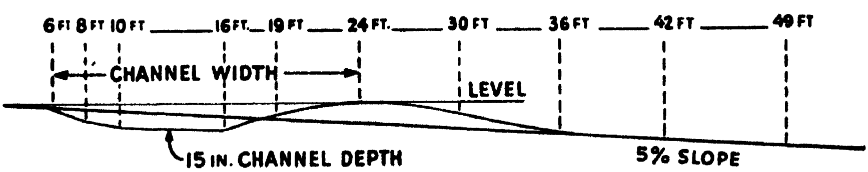


Plate 76.
A COMPLETED BANK, WITH DIMENSIONS INDICATED.

Contour Banks only a Palliative.

These banks are intended only to flow safely from the farm such surplus water as cannot be absorbed where it falls. They are only soil conservation aids, and the objective of the farmer should be the adoption of farming techniques which will ensure the maximum penetration and retention of rainfall at the site where it falls. Farmers are strongly advised not to build contour banks on "trial and error" lines; they must be correctly designed and surveyed first, or disastrous consequences may follow.

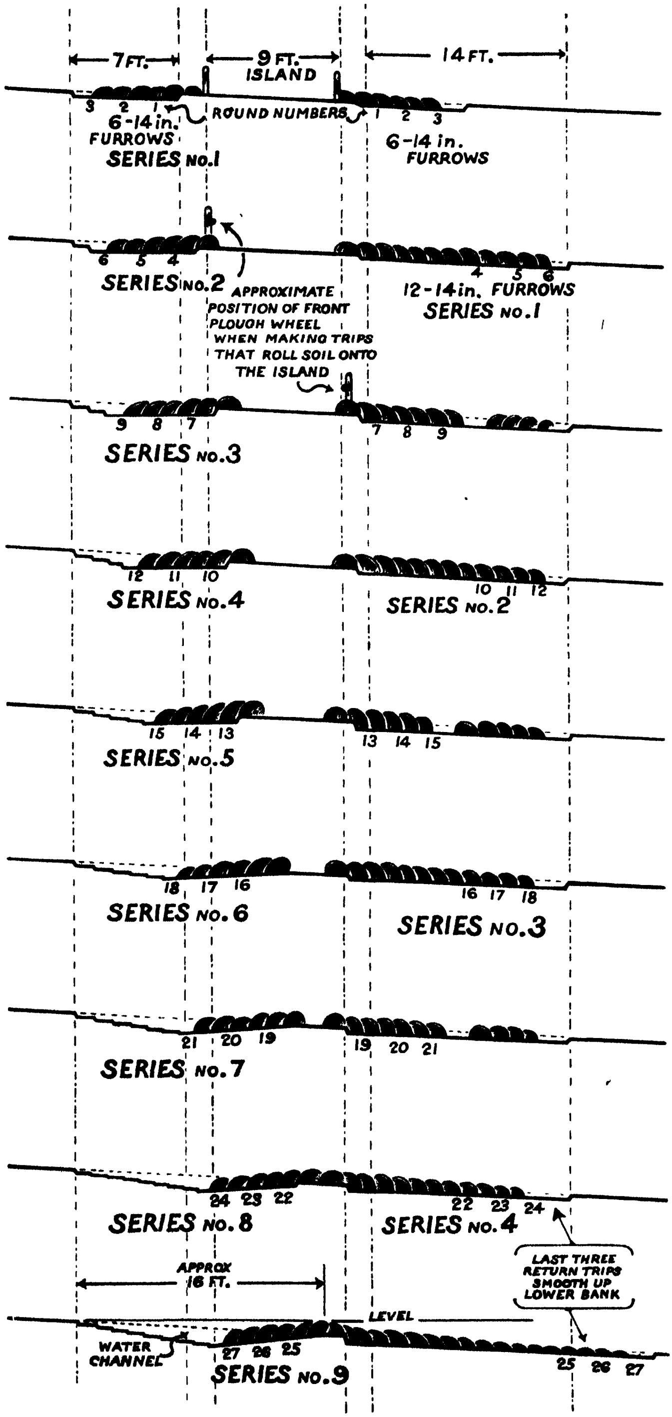


Plate 77.

DIAGRAM OF OPERATIONS IN THE CONSTRUCTION OF A BANK.

The Mango.

S. E. STEPHENS, Horticulturist, Horticulture Branch.

(*Continued from page 82 of the February Issue.*)

PROPAGATION OF THE MANGO.

Raising of Seedlings.

MANGO plants must be raised from seed irrespective of whether the final tree is to be a seedling or a grafted tree. No commercial success has yet been attained in the striking of root or branch cuttings such as is practised with some other fruits. The rooting habit of the seedlings is such that special methods are required to produce plants that will have a good rooting system and so transplant readily. Under conditions of ordinary seed-bed culture, in which soil is worked up to good tilth to form the bed, mango seeds will develop a long tap root with no fibrous feeding roots. The tap root elongates at about two to three times the rate of the top, so that after the initial growth flush the top may be 9 inches high and the tap root—the only root to develop—will be 18 to 24 inches deep. Plants of that type are almost impossible to transplant with any degree of success, so modification of the usual seed-bed method is necessary to produce a transplantable seedling.

The special type of seed-bed necessary for mango raising is made by first excavating the soil to about 8 inches or by building up a board frame 8 inches high on top of the soil. The bottom of the excavation or the earth inside the frame must then be covered with sheet iron. Alternatively, the board frame can be placed on a concrete floor, the object being to isolate the seed-bed from the soil underneath. The frame or the excavation is filled with clean sand of medium-coarse texture. Previous illustrations show the effect which a proper mango seed-bed has on the rooting system of the seedlings. The iron or concrete bottom prevents elongation of the tap root and the sand medium encourages vigorous development of fibrous feeding roots. Plants of this type can be readily lifted from the sand without injury to their roots and they have the necessary root expanse to enable them to establish themselves rapidly when transplanted.

Mango seed must be fresh and is better not dried out before planting. Fully ripe fruit should have the flesh roughly sliced from it with a knife and the remainder of the pulp then washed out with water. Quickest results are obtained by the use of a hose with a solid water jet under good pressure. The yellow pulp is all removed and the seed left with only the clean fibres adhering to it. The washed seeds should then be spread out in the air to dry off excess moisture so that they can

Plate 78.

STAGES IN THE PREPARATION OF MANGO SEEDS FOR PLANTING.

be gripped securely for the next operation, which is husking. Plate 78 shows the various stages of this operation. The three seeds on the top left are cleaned and dried ready for husking. The three on the top right have been clipped round the dorsal edge. This is done with secateurs, care being taken not to cut into the kernel. The two seeds on the lower left have the husks partially prised open. This can be done quite easily provided the clipping has been extended to both ends. In the lower centre of the plate, five husked kernels are grouped, while two opened and empty husks are shown on the lower right.

Husking of the seeds prior to planting is essential to prevent deformed root growth. Plate 79 shows tangled roots developing in an unhusked seed and Plate 80 the deformed root growth and weakened tops obtained when husking is not carried out. These should be compared with the vigorous tops and straight roots that develop from husked seeds as shown previously.

Plate 79.

TANGLED DEVELOPMENT FROM UNHUSKED SEED.

The seeds should be planted in the seed-bed as soon as possible after husking, allowing about six inches between the seeds each way. They must be placed on the ventral edge and set about three-quarters of their depth in the sand. A mulch of straw, blady grass, wood wool, or planing

Plate 80.
ROOT DEFORMITY DUE TO THE SEED HUSK.

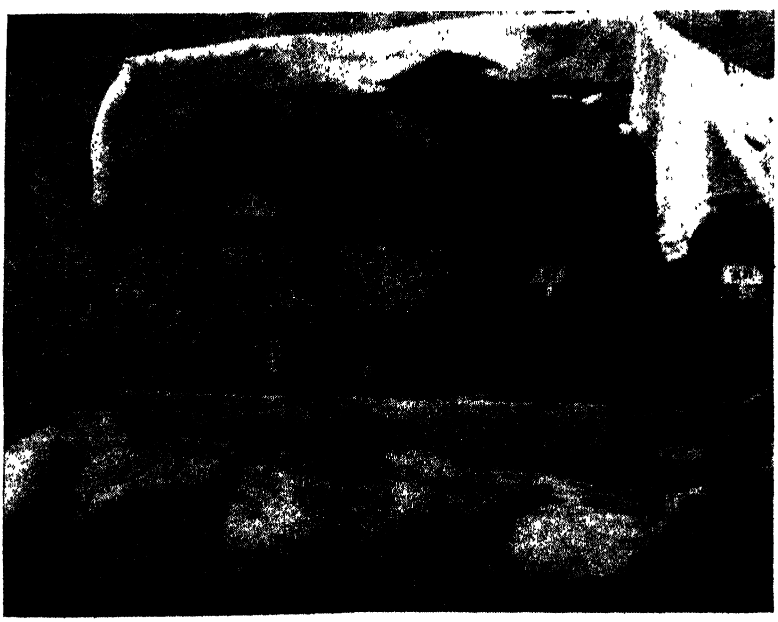


Plate 81.
A MANGO SEED-BED.

mill shavings should then be placed on the surface of the bed, covering seeds and sand. The seed-bed is completed by erecting a hessian or light bush shade about 3 feet above it. Plate 81 illustrates a built-up bed with hessian shade and the plants growing through a blady grass mulch.

The sand medium holds moisture well and the mulch assists in maintaining the moisture right to the surface. Once the seed-bed has been thoroughly soaked the moisture content can be easily kept up by light but regular waterings. Sprouting of the seed commences in 8 to 14 days under tropical summer conditions but may take as long as three weeks in sub-tropical areas. The initial growth flush ripens in about three weeks after germination. When this stage is reached the shelter should be gradually removed over a period of several days.

As soon as the plants have hardened to exposure they may be transplanted to nursery rows or to the field. If they are to be grafted, it is customary but by no means essential to place them in a nursery. Planting direct to the orchard prevents the setback that must take place when a partly-developed evergreen tree is transplanted. Direct planting should certainly be practised if the trees are to be grown as seedlings. If a larger plant is desired for field planting, the seedlings may remain in the seed-bed until they have made and ripened their second flush of growth, but it is not wise to leave them beyond that time as the sand medium contains insufficient nourishment for lengthy subsistence. Transplanting can be accomplished successfully and with very little loss of plants if the leaves are clipped back to half their length and the plants watered in and lightly shaded for a few days with a leafy twig.

Grafting.

As has been explained, mangoes of polyembryonic type can be depended upon to reproduce the characters of their parents in the great majority of cases; so, if they are of a desirable type, there is very little to be gained by grafting such seedlings. However, some of the polyembryonic races have undesirable fruit characters which render them unsuitable for fruit production, but because of their vegetative origin seedlings of these races are very even in type and growth characteristics, and are consequently desirable as rootstocks. The monoembryonic plants are less satisfactory owing to variability in inheritance, which may cause variable growth and so affect the tops that may be grafted upon them. As stock plants for grafting, polyembryonic races of free growth are therefore recommended. The "Common" mango has been found quite suitable for the purpose.

Bud Grafting.

Propagation by bud-grafting is entirely satisfactory insofar as the type of tree produced is concerned but the operation is somewhat more difficult with mangoes than with most other plants with which budding is commonly used. Three methods have been used, all with reasonable success—the ordinary or inverted T bud, the Forkert bud, and the window bud, the last being a special development by the author for mango budding. The great advantage of the window budding method is that it holds the bud in very close contact with the stock—a consideration of particular importance in the case of mangoes, which show a

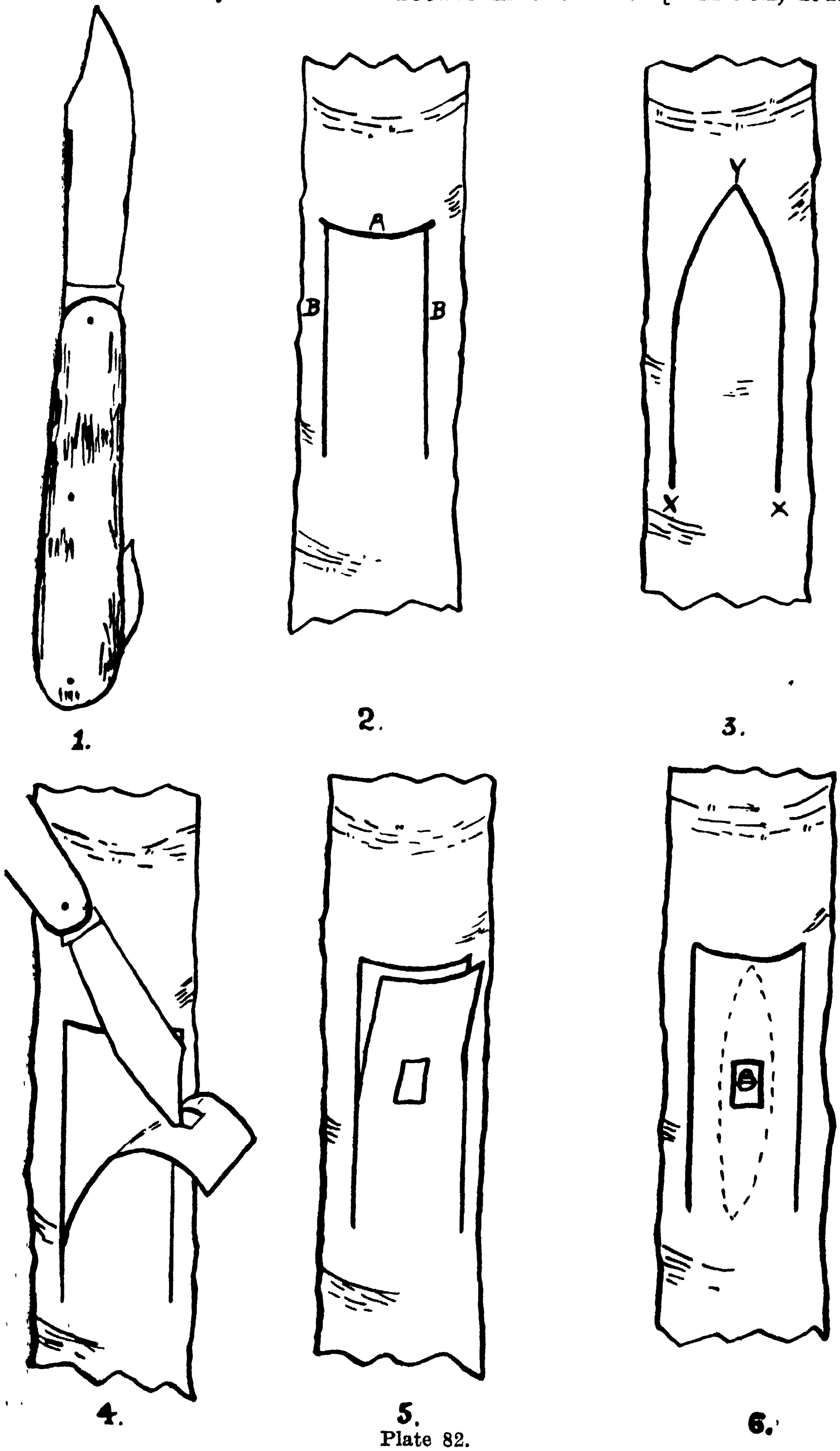


Plate 82.

MANGO BUDDING BY THE WINDOW BUD METHOD.

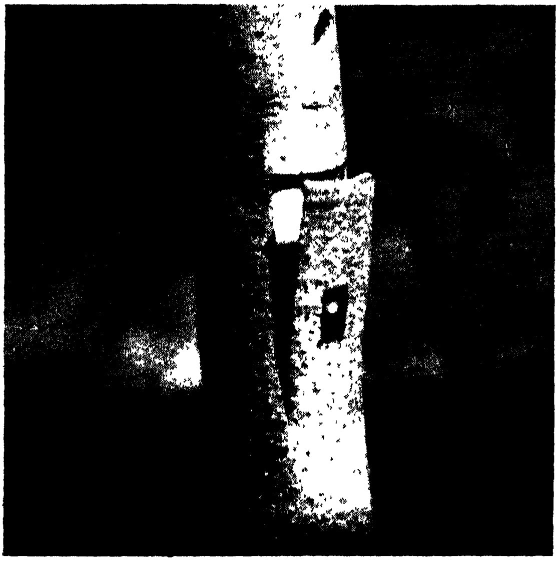


Plate 83.
THE WINDOW BUD—PLACING THE BUD.

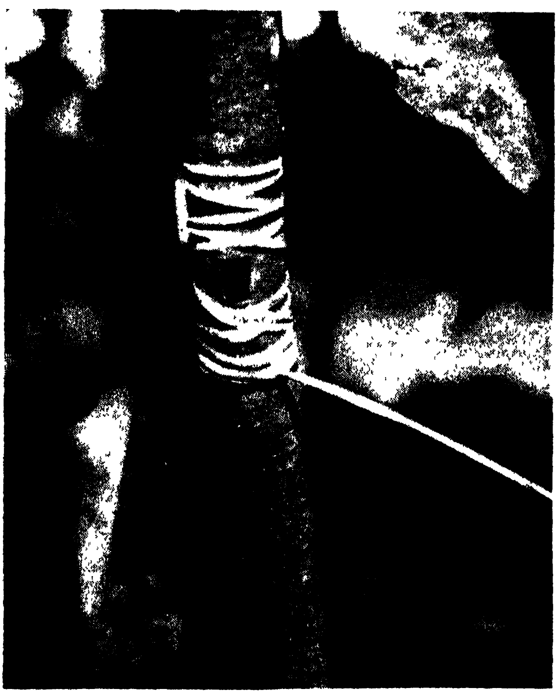


Plate 84.
THE FLAP TIED IN POSITION AFTER INSERTING THE BUD.

pronounced tendency towards the formation of thick corky layers of tissue under the buds with the ordinary T or inverted T methods of budding, thus causing an unsightly and frequently weak union.

Briefly, the method consists in the placing of an ordinary shield bud under a flap of bark turned back from the stock and the cutting of a "window" in the flap before replacing it. Through this window the bud is exposed to view.

Plates 82, 83 and 84 illustrate the operation in detail. A budding knife with a sharp pointed blade, such as that illustrated in Plate 82, fig. 1, is required. Two methods have been used in cutting the flap. It may be done in three cuts, one (A in Plate 82, fig. 2) horizontal across the stock, and two vertical (BB), ½-inch to 1 inch apart, extending from the horizontal cut towards the base of the stock for a distance of about 2 inches; or it may be done with the point of the budding knife in two cuts, starting at XX in fig. 3 (Plate 82), drawing the knife upwards on converging lines to a common point Y. The flap of bark should then be loosened with the point of the knife at the corners AB or Y, as the case may be, and gently pulled away from contact with the wood. This is an important point, as the action of tearing the bark away exposes the cambium layer. Further, it gives an indication as to whether the stock is in a fit state to work, as the bark will peel cleanly and easily only when the stock is in an active condition.

A window is then cut out of the centre of the flap. It should be not more than one-quarter of an inch wide by three-eighths of an inch long. It is cut most easily with the point of the knife from the inside of the flap, which is bent over for the purpose, the tension on the bark assisting in the cutting (Plate 82, figs. 4 and 5).

An ordinary shield bud is then cut from the scion material, the petiole or leaf stalk, if present, being cut back to a stub of about one-tenth of an inch. The bud should be cut rather large—1½–2 inches long. It is inserted without undue delay under the bark flap (Plate 83), and placed in such a position that the bud is visible through the window (Plate 82, fig. 6).

The flap should then be bound back in position with raffia (Plate 84) and the whole sealed with grafting tape or earthed up with soil to completely cover the bud. A convenient method of earthing-up is to bend a sheet of tin of requisite size round the budded plant and fill it with soil. The tin tube should be large enough to allow about 4 inches of soil all round the plant and to cover the bud to a depth of at least 3 inches.

The covering tape or earth should remain in place for about three or four weeks and then be removed and the raffia cut. If the operation has been well performed, the whole flap will have re-united with the stock and the only evidence of its removal will be the window and a narrow line of new tissue along the cuts. The stock may then be ring-barked above the bud, or cut and bent over, to start the bud in growth. After growth has commenced, the stock may be headed back in the usual way.

In this, as in all other budding methods, success lies in cleanliness and neatness in making the several cuts, and in working the stock when it is in active or flush condition, with the bud-wood dormant. Cleanliness of tools is assured by the frequent wiping of the blades with a soft

cotton cloth saturated with alcohol or methylated spirits. Neatness also is assured by maintaining a razor edge on the budding knife. A blade which will not shave is too blunt for budding. A good quality smooth butcher's steel used after every five or six cuts will keep the blade at the required keenness. Active, flush condition of stock may be assured by applying a liquid manure dressing of 1 oz. of sulphate of ammonia in 1 gallon of water several days before commencing the budding.

Under tropical conditions, budding has been successfully carried out at all periods of the year excepting the months of June and July, that is, the cold period. The best condition of the stock for successful budding is between the swelling of the buds and early flush growth when the new leaves are still only partly expanded.

Budwood appears to give the best results if it is cut several days before it is to be used and stored in damp peat moss or wet sand. The best type of budwood is the green wood of the second and third last flushes which is about three-eighths of an inch in diameter. The latest flush should be discarded as it is often insufficiently ripened.

Inarching.

In India, it has been customary over many years to propagate outstanding varieties of monoembryonic type by the grafting method known as inarching. This method involves growing the stock seedling in a pot and raising the pot on a scaffolding to a position in which the seedling can be brought in proximity to a branch of the variety it is desired to propagate. The seedling and the branch must be of about the same thickness and must be so placed that they have the same direction of growth and can be brought into contact over a length of about 6 inches. A slice of bark and wood is removed from the adjacent sides of each and the two cut faces brought together so that close contact is made between the two cambium layers. The union must be firmly tied and waxed over. In the course of time, if the operation has been skilfully performed and the young plant in the pot kept in active growth by frequent feeding, the two shoots unite. When this has taken place the top of the seedling is cut off back to the point of union to divert all the seedling's growth into the scion and after a few more weeks the scion is severed from the parent tree immediately below the union. The inarch is then a separate entity and is removed to a lathhouse for further development and strengthening of the graft before being finally planted in the orchard.

Inarching is a laborious method of propagation and the graft union so made is not a strong one. The method is not recommended to Queensland growers.

[TO BE CONTINUED.]

Citrus Bud Selection in Queensland.

G. W. J. AGNEW, Experimentalist, Horticulture Branch.

AT one time, early in the history of Queensland's citrus fruit industry, the public was mainly supplied with oranges, mandarins and lemons produced on trees grown from seed. Though seedling citrus trees were easily and cheaply raised, and proved hardy when grown under adverse conditions, it was found that the progeny of some varieties did not have the same characteristics as the chosen parent trees. Seedling trees were also very thorny, and often many years passed before they produced commercial crops of fruit. The propagation of seedling trees led to the production of a mixture of types, many of which were inferior in both fruit quality and yields to the original parent tree and the true identity of some of the best varieties was lost. It is recognised, however, that occasionally, useful types of fruit were obtained in this way. The Ellendale Beauty mandarin, which arose as a chance seedling in the Howard district in the latter part of last century, and the Beauty of the Glen Retreat mandarin, which appeared in a similar fashion in 1873 near Brisbane, are well known examples of this.

The introduction of the Bahia Navel orange from Brazil to other countries had a profound effect upon the citrus industry throughout the world. This orange, which later became known as the Washington Navel, bore seedless fruits of high merit and thus could not be propagated by seed. The demand for trees of this variety was largely responsible for the present-day practice of planting "worked" trees in commercial orchards.

"Worked" Trees.

A "worked" citrus tree consists of two components—a stock and a scion or bud. Trees for commercial plantings are produced in nurseries, by first raising seedlings of bush lemon, common sweet orange, Emperor of Canton mandarin and some other varieties as stocks. When this stock plant is large enough—usually at an age of six to 12 months—a bud of a chosen variety is "worked" on to it by an operation known as budding. If the union is successful, the bud begins to grow. That part of the stock plant above the union is then headed back and the bud develops into the new tree, living on the root system of the stock.

To-day, as a result of the almost universal policy of planting "worked" trees, a high degree of varietal uniformity and distinctiveness is obtained in commercial orchards.

Mutation and Its Effect on Bud Selection.

Experience in all citrus growing countries has shown that some trees or parts of trees may develop characteristics which differ from the normal for that particular strain. These are known as "sports" or "mutations." As these mutations occur in the buds, and can be propagated through them, the term "bud variation" is used to describe the phenomenon.

The most important bud variations from the horticultural point of view are those which affect fruit quality, yielding capacity and time at which the fruit matures. Practically all commercial varieties of citrus produce bud variations of different kinds, though some varieties do so more frequently than others.

Some bud variant strains of the Valencia Late orange have demonstrated their unproductiveness by yielding consistently only 20 per cent. of the crop produced by the normal strain. Similarly, in the Washington Navel orange unproductive strains occur as well as several off-type fruit variations such as large and coarse-rind fruits. Excessive thorniness, which sometimes occurs in the Villa Franca lemon, is another example of a variation which may be transmitted by faulty bud selection. A common mutant of the Valencia Late is one producing large fleshy leaves and coarse-rind fruits of poor quality. At least two strains of Joppa orange may be distinguished by their foliage characteristics: one has large twigs with sparse foliage and the other small twigs with a large number of leaves.

Bud variation can be used also to spread the harvesting period of the crop. For example, some bud variant strains selected and propagated in America from the Washington Navel mature their fruit earlier than the standard strain, and others later.

Elimination of Inferior Strains.

Citrus bud variations may lead to the propagation of horticulturally inferior trees, and careful selection of buds is necessary to maintain the standard of a variety. It is considered that bud selection, though it may be of value in isolating superior strains or strains with special characteristics, has as its main purpose the exclusion of inferior trees from new plantings.

Variation Due to Environment.

The bud selector must take into consideration those modifications of a tree's behaviour which may be due to the environment in which the tree is growing. Soil and climatic conditions, and even the age of the tree, may influence the characteristics of a variety. For example, an Ellendale mandarin tree may behave very differently under coastal conditions on the red basalt soil of the Blackall Range at Montville from one growing in the sub-coastal climate of Gayndah on alluvial sandy loam. Other factors, such as the presence or absence of irrigation, differences in fertilizing practices, and the kind of stock on which the trees have been worked, all tend to complicate the work of the bud selector, who has to determine the nature of the variations produced and thus assess the value of a variety or even a tree within a given variety as a source of budwood.

Pedigree Budwood Plots.

At present a programme of citrus bud selection is in operation in Queensland, whereby selected parent bud supply trees are kept under observation and from which performance records are taken. This work is concurrent with the establishment of pedigree plots, in which selected strains of the main commercial varieties are planted under test conditions. One such pedigree plot is already established at the Maroochy Experiment Station in the Nambour district, and another at the Bureau of Investigation Research Station at Lawes, near Gatton. These plots will, in time, provide much of the budwood supplied to registered nurseries.

Citrus Budwood Scheme.

For many years past the Queensland Department of Agriculture and Stock has supplied registered citrus nurseries with buds of standard varieties, selected and cut under the supervision of its officers, in order

to ensure that commercial citrus plantings will, in the main, be comprised of highly productive trees bearing first quality fruit. To illustrate the extent of the bud supply service to nurserymen, it may be stated that, for the autumn and spring buddings of 1948, approximately 200,000 buds were selected, cut and despatched to Queensland nurseries. Since the inception of the Citrus Budwood Scheme in 1934, about 1½ million citrus buds have been supplied for commercial use. About half of these buds were of the three orange varieties—Washington Navel, Joppa, and Valencia Late—the remainder being made up of Ellendale Beauty, Emperor of Canton, and Beauty of Glen Retreat mandarins, Villa Franca, and Lisbon lemons, and Marsh Seedless grapefruit. All of these are listed as "A" grade varieties under the *Diseases in Plants Acts*. Seeds of the more important citrus varieties, grown as stocks for budding, were also supplied to nurserymen.

Prior to 1936, Queensland imported large numbers of "worked" citrus trees from southern States, but at the present time quite a number of trees are exported. Local conditions are such that a large and vigorous "worked" tree can be produced in Queensland nurseries more quickly than in a more temperate climate.

Conditions governing the supply of budwood and seed to nurserymen are as follows:—

Budwood.

Orders for budwood required between 20th January and 20th April must be lodged not later than 7th January, and for budwood required between 20th July and 20th September not later than 7th July.

As from the first budwood supply period of 1949, nurserymen will be charged £4 15s. per 1,000 buds for all "A" grade varieties.

Orders received after the closing dates specified above will be charged at the rate of £5 5s. per 1,000 buds.

Nurserymen shall have the right to question the quality of budwood provided the matter is reported immediately to the officer responsible for budwood supplies. Each complaint will be dealt with on its merits. Nurserymen shall not have the right to reject budwood simply because it has been stored before despatch.

Seed.

The Department of Agriculture and Stock will supply seed of bush lemon, sweet orange and Emperor mandarin during the months of June, July, and August.

Seed orders must be lodged not later than 7th January.

The price of seed to nurserymen shall be cost price, plus 1s. per lb. (estimated at 20s. per lb.).

RADIO TALKS TO FARMERS

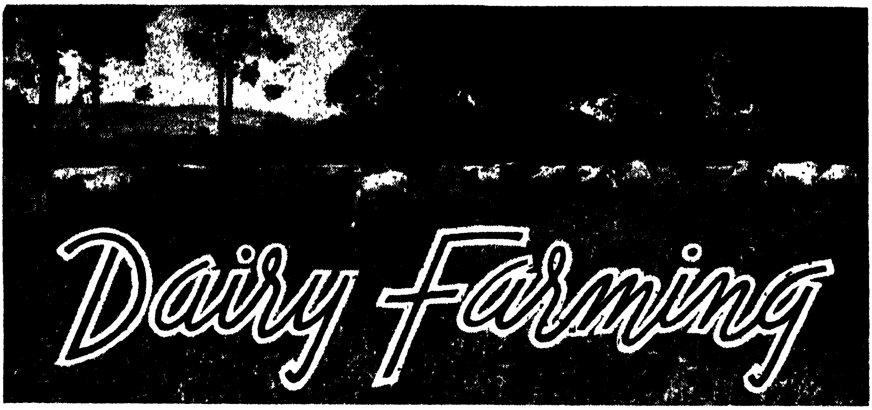
(Australian Broadcasting Commission)

4QR AND REGIONAL STATIONS

THE COUNTRY HOUR—Daily from 12 noon to 1 p.m.

4QG AND REGIONAL STATIONS

COUNTRY NEWS MAGAZINE—Every Sunday at 9 a.m.



Modern Milking Methods.

W. C. T. MAJOR, Dairy Technologist, Division of Dairying.

IN recent years research workers have revealed the intricate physiological mechanisms of the secretion and "let-down" of milk. A simple outline of these findings, and their application to the art of milking, should help farmers to understand modern milking methods.

Structure of the Udder.

The udder of the cow consists of four separate quarters. The diagram in Plate 85 will assist an understanding of its structure.

Each quarter of the udder contains:—

1. *Teat.*—The teat is closed at its lower end by a *sphincter muscle,* which prevents milk flowing from the udder, and restricts the entry into the udder of foreign bodies, including bacteria. The teat surrounds the *teat cistern* and communicates with the exterior via the *streak canal.*

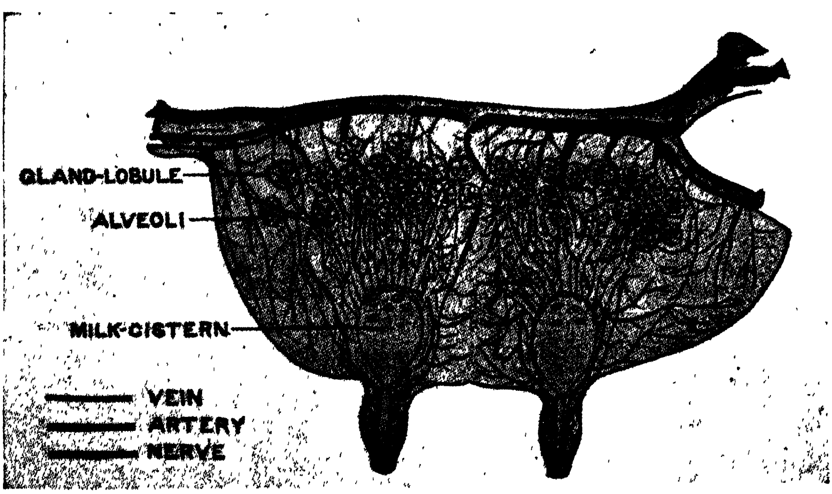


Plate 85.

DIAGRAM OF SECTION THROUGH THE UDDER.

2. *Milk Cistern.*—This is a small reservoir within the udder. It opens into the teat cistern.

3. *Milk Ducts.*—The milk ducts permeate the tissue of the udder. They open into the milk cistern.

4. *Alveoli.*—These are tiny, cell-lined sacs at the apex of the ducts. The transformation from blood plasma to milk occurs within the cells lining the alveoli.

5. *Blood Vessels, Muscles, Nerves.*—The tissue of the udder and teats is well supplied with blood vessels, muscles and nerves.

Secretion of Milk.

Substances digested from the cow's food supply are conveyed to the udder by the blood stream. Selected substances pass into the cells lining the alveoli, and are there manufactured into milk. This milk is secreted into the space within the alveoli. Milk first collects in the alveoli and then passes down the ducts into the udder and teat cisterns.

Not many years ago it was widely believed that milk secretion only occurred during milking. It has now been demonstrated that milk secretion takes place over a much longer period. The rate of secretion is influenced by the pressure developed within the udder. During milking the pressure within the udder falls and secretion commences. It continues until sufficient pressure develops within the udder to stop secretion. In normal, well fed cows approximately eight hours elapse from the commencement of secretion until the rate of secretion commences to decrease considerably. However, it may be 14 hours before secretion apparently ceases—unless milk is removed from the udder during this interval.

Because of the influence of pressure on the rate of secretion, it is possible to increase the yield of heavy producing cows by milking them three times a day. This increase may be as large as 15 per cent. of the twice-a-day yield when the cows are fed to the limit of their capacity. Regularly spaced milking intervals will also increase yields, irrespective of whether the cows are milked twice or three times per day. Milking at regular intervals is also desirable to obtain milk of uniform composition and particularly to avoid low fat milk at certain seasons of the year with some breeds of heavy milking dairy cattle.

Milk " Let-Down."

Milk " let-down," unlike secretion, is not a continuous process, but only occurs as the result of stimulation. The suckling of her calf is the strongest milk "let-down" stimulus a cow can receive. In normal milking this stimulus is best provided by adequately washing the cow's teats and udder with warm milk (110 deg. F.).

Stimulation of the nerve endings in the cow's teat causes an impulse to be transmitted to the pituitary gland at the base of the brain. This impulse causes the pituitary gland to secrete a hormone (oxytocin) into the blood stream. Oxytocin is carried by the blood stream to the udder, where it causes contraction of the muscle fibres surrounding the alveoli, thus developing additional pressure within the udder. It takes about 45 seconds from the stimulation of the teats until milk " let-down " occurs. Active muscular contraction

persists for approximately six minutes. The bulk of the milk within the udder is held in the spongy secreting tissue and is most difficult to remove unless the tiny muscles permeating the tissue squeeze it out. It is therefore important to:—

1. Commence milking one minute after washing the teats and udder;
2. Milk fast enough to effectively empty the udder within four minutes.

The following diagram illustrates the mechanism of milk "let-down."

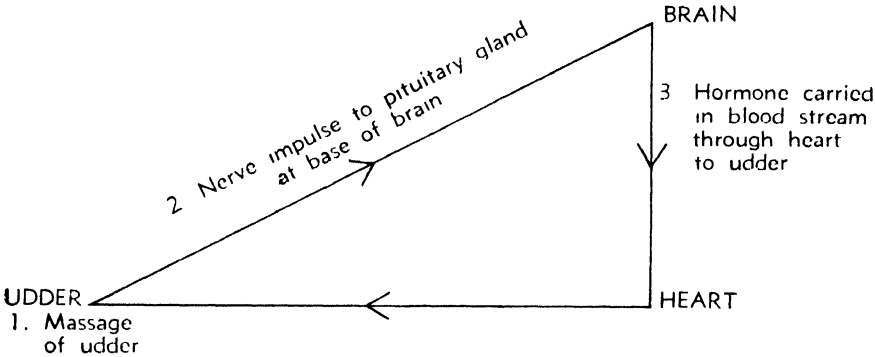


Plate 86.
DIAGRAM OF THE MECHANISM OF MILK "LET-DOWN."

Cows normally associate with milking such actions as—

1. Coming to the milking shed;
2. The normal sounds of the shed; and
3. The milking routine.

In so doing cows develop a "conditional reflex," or habit, which stimulates milk "let-down." Thus, cows with unwashed teats and udders can be trained to let down their milk. However, "let-down" due to habit alone is neither as definite nor as persistent as "let-down" due to habit supplemented by warm udder wash. Correct stimulation permits more milk to be removed from the udder. It also permits milk to be removed more quickly.

Cows are susceptible to stimulation by hormones other than oxytocin and some have an important bearing on milking. For instance, fear, anger and frustration cause the suprarenal glands to secrete adrenalin into the blood stream. Adrenalin prevents contraction of the muscle fibres within the udder and so inhibits milk "let-down" by counteracting the effect of oxytocin. Therefore, handle cows quietly. Never excite them.

Thus, for complete milking, it is necessary to have:—

1. A complete absence of counterstimuli, such as fear, anger, frustration or excitement.
2. A definite udder and teat stimulation—preferably by a warm wash.
3. Rapid removal of milk from the udder while the "let-down" stimulation still strongly persists.

Hand Milking.

During hand milking the upper portion of the teat cistern is closed by the pressure of the hand. As the hand closes, the milk so trapped in the teat cistern is forced to issue from the teat. The pressure developed within the udder by secretion and muscular contraction causes milk to flow into the teat cistern as soon as the hand releases the teat. Hand milking results in an intermittent flow of milk from two teats at a time.

Few milkers have either the ability or the endurance to consistently remove milk from cows quickly enough to completely empty the udder before the effect of the "let-down" stimulation has markedly decreased. With hand milking, the milker is the limiting factor in milk removal—not the cow.

Machine Milking.

Milk is removed from the cow by suction during machine milking. There is sufficient difference in pressure between the interior of the milking machine cups and the interior of the udder to permit an almost continuous flow of milk from each teat.

The effect of squeeze-and-release induced by the pulsator is to massage the teat in order to maintain blood circulation in the teat and so avoid congestion and discomfort. Unless the squeeze interval is long enough to retard milk flow (as may occur with slack, soft inflations), the rate of squeeze to release has little effect on the rate of milking. The effective flow of air through the milking machine influences the rate of milking more than any other factor—provided the machine is otherwise operating efficiently. Effective air flow is influenced by—

1. Capacity and efficiency of the vacuum pump;
2. Leaking joints, flaps and poorly seated pulsators;
3. Sensitivity of the relief valve;
4. Cleanliness of the air admission hole.

Provided that milking machines are in good mechanical condition, the cow, rather than the machine, is the limiting factor in the rate of machine milking. Thus, for efficient machine milking, it is important that—

1. Cows are properly prepared;
2. Machines are mechanically efficient;
3. Shed layout and routine are designed for rapid milking.

The Art of Milking.

Cows are creatures of habit, and regularity in the routine of milking and feeding pays dividends. Do the same things, in the same order, at the same time, each day. The cows like it that way.

The following routine gives excellent results:—

1. Before commencing milking, thoroughly prepare the milking equipment. It must all be thoroughly rinsed, cleaned and sterilized between milkings.

2. Bring the cows quietly from the paddocks to the dairy. Don't use savage dogs, whips or other harsh treatment. Well trained cows do not require to be driven to a dairy.

3. Milk the cows at regular intervals. This will increase production, and help to overcome low fat problems which some milk suppliers experience during certain seasons of the year.

4. At the yards provide drinking water, shade and protection from prevailing winds.

5. Provide yards of adequate size to comfortably hold the cows. Dehorning makes cows quieter and reduces distress—especially of heifers.

6. Train the cows to pass quietly through the yards and shed. This means more milk and less labour. Gentle handling, rapid milking, and feeding after milking will assist training. The well trained cow regards milking as a pleasure. She comes into the bail of her own accord. She does not foul the bail. Cleaning problems are simplified and the dust menace is reduced.

7. As the cows come into the shed they are "bailed-up" and leg-roped where necessary. Both operations can be dispensed with when the cows are well-trained. This not only reduces labour, but also simplifies milk quality problems by avoiding potent sources of contamination.

8. Wash the hands thoroughly before commencing to milk the herd and rinse them before milking each cow.

9. When the cow comes into the bail, thoroughly wash and dry her teats and udder using warm water and a clean cloth. It is an advantage to use a hypochlorite disinfectant in the water. As the disinfectant action of hypochlorites is rapidly destroyed by organic matter, it is necessary to renew the solution during milking. Teats must be thoroughly dried—otherwise a drop forms on the sphincter muscle, thus localising contamination at the very spot where it is least desirable.

10. As soon as washing and drying are complete, take a few squirts from each teat on to a strip cup. Examine for abnormalities. If abnormal, the cow should be held back until last and hand-milked.

11. Place the cup on the cow's teats one minute after commencing to wash her teats and udder. This is important for rapid milking.

12. As milk is removed from the udder there is a tendency for the cups to creep upwards on the teat. This closes off the teat cistern from the udder cistern and stops the removal of milk from the udder. It also causes the delicate inner lining of the cistern to rub on itself. This may result in an injury which permits bacteria to enter and cause mastitis.

When the cups creep—gently pull them down.

13. As soon as active milk flow ceases (as indicated by the sight glass and the appearance and feel of the udder), *bear down gently on the cups.* Frequently milk flow becomes active again for a short time. Remove the cups as soon as this flow slows down. Never leave the cups on a cow after a free flow of milk has ceased. Leaving the cups on too long trains the cow to develop sluggish milking habits, which will decrease her yield and increase the cost of milking.

14. After milking each cow dip the cups in clean water and then in strong chlorinated water. This is particularly important where mastitis is troublesome. Never knowingly place cups on any quarter affected with mastitis.

15. Then place the cups on the next freshly prepared cow. This routine is carried on until all of the cows have been milked.

16. Start the separator at such a stage during milking that separation is almost completed when the last cow is finished milking. Separate to a fat content of not less than 34 per cent. in winter and 38 per cent. in summer. This has an important influence on cream quality as well as transport costs. Do not separate cream to contain more than 42 per cent. fat—very high fat creams mean high fat losses.

17. As soon as practicable after milking rinse the milking machine and all utensils with clean water. Then proceed with cleaning and sterilization.

18. Clean up the manure, sweep and hose the shed floors and leave everything clean, neat and tidy for the subsequent milking.

19. After milking feed the cows in clean, detached feeding stalls. The amount and nature of their supplementary feed depend on—

(*a*) Productive capacity of the cow.

(*b*) Nature and amount of the feed available in the paddock.

(*c*) Relative prices of feed and dairy product.

Non-stripping.

The majority of cows can be trained to milk out completely in 3 to 4 minutes and to maintain production without stripping.

The advantages of non-stripping are—

1. A very definite labour saving.
2. Faster milking; that is, more cows can be milked in a given time.
3. Milking becomes more attractive to labour.

Non-stripping causes no loss of production and drying-off is not accelerated. It has also been claimed that non-stripping leads to improved milk quality and lowered incidence of mastitis.

Cows must be trained to non-stripping methods. This training involves:—

1. Adherence to the modern milking methods already outlined. Cows must be efficiently milked before non-stripping is attempted.

2. Remove the cups 4 minutes after milking has commenced (or earlier if free flow ceases). Hand strip to determine the amount of strippings.

3. For several milkings remove the cups 4 minutes after milking commences. Bear down on cups before removal. *Do not hand strip.*

4. Then determine the amount of strippings recovered. It will be found that some cows have not milked out completely. These cows require further training. Treat them as follows:—

(*a*) Very thoroughly wash and massage the teats and udder before milking is commenced;

(*b*) Massage the udder gently during the last 2 minutes;

(*c*) Gently bear down on the cups during the last minute.

5. Check the effect of this treatment on the amount of milk remaining in the udder by hand stripping at weekly intervals. As soon as practicable progressively reduce the amount of udder massage and the duration of bearing down on the cups.

By these methods more than 80 per cent. of the herd can be trained to non-stripping. The remaining, apparently untrainable, cows are a problem. It is for the farmer to decide, on economic grounds, whether they are to be retained in the herd and milked last, or replaced by trainable heifers. Frequently, aged cows will only fully respond to training at the commencement of a lactation.

Summary.

Modern milking methods involve—

1. Correct stimulation of the cow.
2. Gentle handling and correct training of the cow.
3. Efficient milking machines.
4. Shed and yards designed to permit rapid milking.
5. No hand stripping.

Remember:

Slow milking makes a cow a "stripper."

Rapid milking makes a cow a "milker."

BETTER DAIRYING DEMONSTRATIONS.

The initiation of a series of dairy farm demonstrations has been announced by the Minister for Agriculture and Stock (Mr. H. H. Collins).

The purpose of the demonstrations, which are being financed by a Commonwealth grant, is to provide an object lesson for dairymen in what may be achieved by the adoption of improved production methods.

To date, arrangements have been made with 29 farmers to adopt various approved practices on their farms, and it is planned to extend the demonstrations throughout the main dairying districts. Special supervisors have now been appointed to the Moreton district and the Darling Downs.

Demonstrations will be made of the value of such measures as pasture improvement, culling of poor producers, improved feeding practices and fodder conservation in economically increasing milk and cream production. The effects of modern methods of milking will also be measured, especially the saving of time which would permit of greater attention being given to the growing and conservation of fodder.

Mr. Collins said that the dairy farms which have been selected are typical of those in their districts, and the results achieved should therefore be capable of duplication by dairy farmers generally.

The value of such demonstrations depends, said Mr. Collins, on the extent to which they are brought to the notice of those engaged in the industry. Accordingly, as the work progresses, field days will be arranged at which the results can be demonstrated to district farmers and their application discussed.

DIVISION OF DAIRYING.

GROUP HERD RECORDING SCHEME.

SUMMARY OF HERD RECORDING UNITS FOR JANUARY, 1949.

District	No. of Herds in Group.	No. of Cows in Group.	Daily Average for all Cows in Group.			Average of Highest Herd in Group.		
			Milk. Lb	Test. Per Cent	Fat. Lb	Milk. Lb.	Test Per Cent.	Fat. Lb.
Beaudesert	17	955	15.52	3·92	·608	20·13	4·86	·978
Maleny, No. 1 .	19	835	17.47	4·86	·85	21·14	5·6	1·183
Maleny, No. 2 .	18	912	17.98	4·66	·839	29·52	5·1	1·506
Oakey, No. 1	22	760	21.47	4·47	·958	22·75	5·59	1·272
Oakey, No. 2 . ..	22	767	20·99	4·27	·895	22·29	5·56	1·239
Allora	9	282	22·76	4·23	·962	26·77	4·39	1·175
Goomeri	18	778	14·13	3·73	·527	22·22	3.5	·777
Cooroy, No. 1 ..	22	831	14·38	4·17	·600	27·88	4·59	1·281
Cooroy, No. 2 . ..	22	760	12·27	4·19	·514	16·57	3·89	·645
Kingaroy, No. 1 . .	20	846	19·74	4·16	·82	30·62	3·98	1·218
Kingaroy, No. 2 ..	19	676	18·54	3·95	·732	26·03	4·07	1·06
Cedar Pocket . ..	22	693	17·95	4·41	·791	22·73	4·56	1·036
Monto	21	813	20·14	4·08	·817	24·16	4·57	1·104
Pomona	19	815	14·55	4·15	·603	18·88	4·63	·874
Miva-Theebine ..	15	718	14·41	4·25	·613	17·5	4·61	·806
Warwick	20	759	24·54	3·95	·969	32·74	4·49	1·469
Kenilworth	17	835	13·27	4·07	·54	18·04	4·55	·82
Killarney	17	776	19·62	4·24	·832	30·76	3·95	1·216
Toogoolawah	16	812	15·71	3·88	·609	19·86	4·28	·85
Toowoomba, No. 1 .	17	648	19·4	4·55	·883	21·29	5·07	1·08
Toowoomba, No. 2 ..	15	680	20·48	4·26	·872	33·00	4·03	1·328
Malanda	22	830	17·17	3·98	·682	28·9	4·02	1·162
Millaa Millaa ..	17	621	18·21	4·34	·791	18·05	5·51	·995
Kilcoy	20	921	14·49	4·17	·604	22·82	3·44	·784

Preparing for Shearing.

R. B. YOUNG, Senior Adviser in Sheep and Wool.

SHEARING might be regarded as "harvest time" in the sheepman's year and it is important that preparations should be carried out well in advance. This calls for attention to an infinite amount of detail and, while this may in some respects be boring, carefully made and executed plans will ensure smooth running of the shed as well as reflect efficiency of management.

With his part of the job thoroughly prepared the woolgrower need not fear trouble just around the corner and he can feel assured that he has reduced to a minimum the risk of loss of time and money from preventable delays. For those to whom the problem is comparatively new and to aid the memories of those to whom preparing for shearing is an old story, some of the main points requiring attention are detailed in this article.

Arranging to Shear.

Make arrangements for shearing well in advance, as many other flocks have to be shorn as well as your own. If the work is to be done by contract it is as well to compare prices and conditions submitted by several contractors.

The relative advantages of "price per head" and "cost plus" are worthy of consideration and might be summarised by saying that a price per head basis is advantageous to the grower if wet weather develops as he is not called upon to pay for the delay. If the weather remains favourable, however, "cost plus" is probably the cheaper.

In arranging to do the work, specify cost, advise the approximate number of sheep to be shorn, with dissected figures of grown sheep, lambs and rams, and if any preference is to be given as to the order of shearing. This is most important when the Mules operation is being practised. Stipulate if plant and machinery are to be supplied and specify details to the contractor. If part of the plant and machinery is supplied by the contractor and the remainder by the property, be sure that each party knows the items for which he is responsible, otherwise delay and/or duplication and additional expense may result. For purpose of record obtain the number of the contractor's Workers' Compensation Insurance Policy. Make arrangements with a reliable carrier to move the wool and order railway trucks.

Woolgrowers are obliged under the Shearing Industry Award to notify the Industrial and Machinery Inspectors of the intended shearing one week prior to the anticipated commencement of the work. However, their obligations do not stop there. Important preparations have to be made at the shed and amongst the flock.

Preparing the Flock.

Boundary and sub-division fences of all paddocks to be used at shearing and following shearing should be put in good order. Nothing is more annoying or detrimental to accurate counts than having shorn sheep in amongst the woollies, or worse still, woollies in amongst the shorn sheep.

Sheep mustered some time prior to shearing into handy concentrations towards the shearing point, so that easy cuts can be obtained for shearing from day to day, and carry-overs returned easily at week ends, will facilitate keeping the sheep up, and avoid danger of "no sheep."

It will be appreciated that the additional mustering will be a heavy tax on the horses and it is advisable to have them in good order prior to the commencement of the work. Pre-attention to trimming of feet and shoeing, if necessary, will ensure that sufficient animals are available for the work.

Provided the feed and water are good, the handiest paddocks possible should be used for shorn sheep. This makes the work easier and allows the animals a few weeks to pick up again before being returned to their usual paddocks.

No sheep should be kept in the yards more than one night and special care must be taken with ewes which are in lamb. In any case, carry adequate calcium-boro-gluconate and a hypodermic syringe on hand in case of milk fever.

Sheep must not be put in the shed yards less than four hours prior to shearing, except, of course, ewes with lambs or animals which are drought stricken. Reasonably empty they are easier to shear and less likely to suffer injury. In most instances sheep are put in to the shed the night prior to shearing, and accurate forecasting of sheep required for each day's shearing is an indication of good management.

Take particular note of the health of the sheep, particularly of the younger age groups, for a month or so before shearing, and if there is any apparent abnormality seek the advice of the nearest stock inspector or sheep and wool advisory officer.

Preparing the Shed and Yards.

It is advisable to have a general "spring clean" of all buildings concerned with shearing. This includes the shearing shed itself, classer's floor, wool bins and wool room. This should also include cleaning of the counting-out pens, and if necessary, underneath the shed, though this is a job which should always be done immediately after shearing is finished. All old wool, black wool, locks and crutchings, as well as skins, should be removed from the shed, as they are only likely to confuse the presser.

It is advisable to give the machinery a trial run, and check over the press. Replace any worn cores, ropes or boards, and oil and grease all working parts as required.

The spring cleaning should also extend to the shearers' accommodation, including mess room, baths and lavatories.

Check the yards to see they are sheep-proof and the counting-out pens to make sure they will hold lambs. Make sure all gates will swing and close properly. Some good clips are depreciated through dust. This can be reduced by watering the yards prior to shearing, and the working of the sheep through the yards will be greatly facilitated if they are free of dust.

On the day the shearers arrive an adequate supply of boiling water, sufficient fresh meat hanging ready for use in butcher's shop, clean cooking utensils, clean and filled lanterns and a general appearance of tidiness will give the impression of efficiency and thoughtfulness in preparing for the work in hand.

Check over the plant and materials and make sure that the items listed below are available.

Accommodation for Shearers and Shed Hands.

Stretchers
Mattresses and covers
Pillows and covers
Lanterns
Kerosene
Adequate water
Basins
Wash tubs
Water tins
Showers
Refuse boxes or drums
Disinfectant
Firewood
Brooms

Shearers' and Shed Hands' Mess.

Bread knife
Bread boards
Billy cans
Boiler
Bowls
Cake moulds
Crockery plates and dishes
Camp ovens for outside
Dipper
Egg slice
Egg whisk
Frying pan
Flour sifter
Funnels
Forks
Forks (cooking)
Hooks, wire, for lifting
Kettle
Knives (table and large)
Mincer
Mixing dishes
Meat dishes
Mugs (delf)
Rolling pin
Rolling board
Saucepans
Strainers
Spoons (table and cooking)
Salt and pepper shakers
Tea urns or large teapots
Tins for groceries, cake and biscuits
Tin openers
Bell
Clock
Broom
Cooler
Cupboards
Shelves
Stove
Tables
Forms
Carbide lights and spare burners
Carbide
Fly spray and atomisers
Mosquito net for food
Kerosene and pump
Disinfectant
Matches
Soap
Washing soda
Tea towels
Dish cloths
Washing-up dishes and mops
Firewood
Kindling
Newspaper
Meat house
Meat safe
Butcher's Block and counter
Butcher's knives
Steel
Meat saw
Tomahawk
Meat hooks for meathouse and safe
Coarse salt
Gambil
Water supply
Tins for water
Water bag
Tumbling Tommy and cover, or refuse bins and covers
All rations required under Award

Wool Shed.

Award
Clock
Bell
Tally board
Millet brooms
Wool baskets
Classer's table and wool-rolling tables
Necks table
Pieces table
Fleece bins
Sheep dip and tins and swabs
Wool press and cables
Press pins
Wool packs and caps
Bale fasteners
Bale branding ink
Brush
Tin
Stencils complete
Raddle
Pack needle
Twine
Scales
Wool book
Pencils
Wool hooks
Spares for wool press
Wool loading ramp or hoist
Overhead gear and spares
Down tubes
Handpieces and spare
Spare cores
Machinery oil
Shearers' oil cans, screwdrivers, brushes, and tins
Expert's bench
Vyce
Expert's tools
Shearing duplicates
Engine
Petrol
Oil
Water
Engine belt
Spare belt and clips
Spare spark plug for engine
Sufficient spares for engine
Grinder
Pendulum
Grinder spanner
Grinder belt
Spare belt and clips
Emery (coarse and fine)
Glue
Glue brush
First aid kit
Bandages, cotton wool, iodine, lint, scissors, antiseptic
Calcium boro-gluconate and syringe
Tar brands
Branding fluid and tins
Lamb marking knives
Ear pliers
Dagging shears
Raddle (blue and red)
Axe
Crowbar
Shovel
Posthole shovel
Rake
Saw
Claw hammer
Nails (clump head and wire)
Pliers
Wire
Tally book
Classer's abstracts
Pencils
Paper
Shearers' and shed hands' agreements
Check wool shed telephone
Check wool shed water supply

STATISTICS OF PRIMARY PRODUCTION.

The annual collection of statistics of agricultural, dairying and pastoral production is being made as usual by the police on behalf of the Queensland Government Statistician. Returns are for the 12 months ending 31 March, 1949, and any producer who does not receive a form by early in April should contact a Police Station or a District Statistician.

Accurately compiled returns are essential if the statistics collected are to have their fullest possible value, and producers are urged to make as accurate returns as possible. Individual returns are treated as strictly confidential.

Cattle Fattening in the United States.*

C. J. McKEON, Director of Agriculture.

A FEATURE of American agriculture is that practically all maize grain and also a large proportion of other grain and hay crops is retained on the farms on which it is produced for feeding to stock.

As an instance of the extent to which hand feeding of beef is practised, I might mention that on one property which I visited in California 2,300 head had been fattened and sold during the first nine months of the year and several hundred were in the yards in various stages of preparation. It was intended that the output for the whole year should be approximately 3,000 head. These cattle were well-bred Herefords and when brought into the yards would be from 18 to 20 months old. They were very intensively hand-fed for an average of three months before being marketed at from 900 lb. to 1,100 lb. live-weight.

On this particular property the ration consisted of 8 lb. grain (barley), 2 lb. molasses, 16 lb. lucerne chaff, and 2 lb. cottonseed meal. With the exception of the concentrates, the whole of the feed requirements were produced on the property on which the cattle were being fattened. The weight gain per head for the whole of the cattle which had been marketed for the year was 2.12 lb. per day, and the best gain was 2 5 lb. per day.

From observations that were made, it would appear that quite a large proportion of the choice hand-fed cattle which are marketed come from farms on which only a small number can be handled at a time. As in the case of the larger holdings, they are heavily fed on a grain and hay ration with a concentrate in the form of either cottonseed meal or soybean meal. The amount of flesh they carry is remarkable and as they are confined usually to small yards or pens they cannot lose any condition by undue exertion. As a matter of fact, they are so heavily fed that they show no desire to walk any further than is absolutely necessary. They are transported in motor trucks from the farms to the market and consequently are slaughtered very shortly after leaving the feeding pens.

* This note records some impressions of cattle fattening gained by Mr. McKeon on the occasion of a visit to the United States as a member of a committee investigating the soybean industry.

Plate 87.
SUGAR BEET PULP STORAGE TANK.

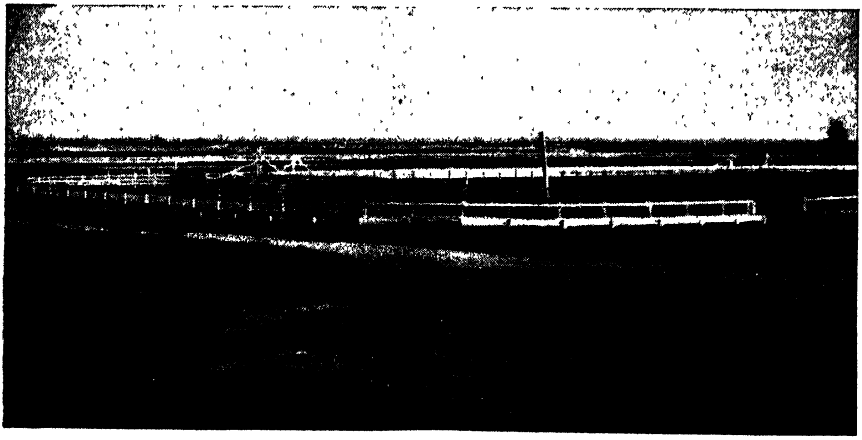


Plate 88.
CATTLE FATTENING PENS.

In the States in which sugar beet production is carried out, sugar beet pulp is used very extensively for cattle fattening. Plates 87 and 88 give some indication of the scale on which this is carried out. Plate 87 shows an enormous container with the beet factory in the background. The pulp is pumped from the factory and can be seen dropping into the container from the elevator in the centre. Some idea of the tremendous capacity of this container will be gained. Plate 88 shows the extensive pens in which cattle are fattened.

The market prices for hand-fed cattle at the time of my visit were as high as 32 dollars per 100 lb. live-weight—the equivalent of £100 Australian for a beast of 1,000 lb. live-weight. The price for this class of beef is naturally high when compared with Australian prices, but the quality is magnificent and it is easy to imagine people who are in a position to do so paying the high price.

After seeing the cattle fattening industry in the United States as it is carried out on both small and large holdings, I consider the possibilities of topping off good quality young beef cattle in Queensland should be thoroughly investigated. With present prices for grain and chaff, to say nothing of the shortage of concentrates, difficulties would be encountered, but it is considered that small trials might well be conducted to determine what price would have to be charged for hand-fed quality beef, and also to determine what the public reaction would be to the retail price of that class of beef.

On the Darling Downs, and in other districts where machinery is available for mechanical harvesting, grain sorghums can be produced at much the same cost per acre as wheat, with the yield for grain sorghum at least 50 per cent. greater than that for wheat. Lucerne can also be grown extensively in those districts and with modern haymaking and baling equipment can be produced cheaply. The provision of a protein-rich concentrate would be a more difficult matter and would depend largely on the expansion of seed crops yielding high-protein by-products.

QUEENSLAND SHOW DATES.

Barcaldine	May 13-14	Kingaroy	May 5-7
Beaudesert	May 6-7	Laidley	July 8-9
Biggenden	April 28-29	Longreach	May 3-5
Blackbutt	June 3-4	Lowood	June 10-13
Boonah	June 3-4	Mackay	June 28-30
Bowen	July 6-7	Maleny	May 12-13
Brisbane R.N.A.	August 6-13	Marburg	May 13-14
Bundaberg	June 9-11	Maryborough	June 2-4
Charleville	May 18-19	Miles	April 12-13
Childers	June 6-7	Mitchell	May 11-12
Chinchilla	April 7-9	Mount Morgan Show	June 2-3
Crow's Nest	May 27-28	Mt. Morgan Camp Draft	June 4
Dalby	March 31-April 2	Mundubbera	May 6-7
Dirranbandi	May 27-28	Murgon	May 19-21
Esk	July 1-2	Nambour	July 7-9
Gayndah	April 21-22	Nanango	April 28-30
Gin Gin	June 13-14	Proserpine	July 1-2
Goombungee	May 21	Rockhampton	June 22-25
Goomeri	May 24-25	Roma	May 4-5
Goondiwindi	April 30-May 2	Toogoolawah	June 17-18
Gympie	May 26-28	Townsville	July 12-14
Home Hill	July 1-2	Wallumbilla	April 29-30
Ingham	July 15-16	Warrill View	May 21
Ipswich	May 17-19	Wondai	May 12-14
Jandowae	April 4-5	Yarraman	April 22-23
Kalbar	May 28		
Kilcoy	June 24-25		
Kilkivan	June 10-11		

Castration of Pigs.

F. BOSTOCK, Officer in Charge, Pig Branch.

THE castration of the male pig is a necessary and most important operation which must be attended to both by stud breeders and by farmers breeding for commercial purposes.

Castration is essential, not only because it enables the farmer to control the breeding operations at his piggery without hindrance, but because of the advantages to be gained in so far as pork and bacon are concerned, resulting in the production of a carcass free from sexual odours and flavours in the meat, while the flesh is much improved in grain and quality.

Unfortunately many owners feel that the correct methods of castration are too much bother and that "bush" methods are the most practical for general use, but one has only to visit the bacon factory or meatworks to realise the number of pigs which have been improperly castrated and which suffer partial condemnation as a result of abscess formation, &c.

Although no statistics are available to indicate the percentage of pig carcasses passing through these establishments suffering as a result of improper castration and from the effect of neglect following customary methods of performing this operation, it is certain the percentage is higher than it should be, or than the industry can afford.

Much can be done to minimise losses and ensure successful work by following the details as outlined herein, and if one item should be stressed more than another it is cleanliness in all operations. There is no reason why ill effects should follow such a simple operation if it is carefully performed, nor should there be any check in growth or development of the animal if the operation is carried out at the correct age before weaning.

Some overseas authorities refer to the term "castration" as applying to the removal of the testicles from the male, and also the ovaries from the female, but in Australia the term "spaying" is universally used in referring to the operation of surgical removal of the ovaries of the female. The pig farmer need not, however, be concerned with

spaying, for it is an unnecessary operation and is not recommended. It is unnecessary by reason of the fact that, under normal conditions of management, the sow pig under six to seven months of age will not be affected sufficiently in growth and development by her usual three-weekly periods of oestrum to warrant the operation, and not recommended because it is a risky and complicated operation which in general should only be performed by an experienced veterinarian.

In the case of male pigs a strong sexual odour is noticeable when a boar pig has been slaughtered, and this odour develops into a most unpleasant flavour in the meat, particularly during its preparation for the table. Fortunately these sexual odours and flavours disappear in the case of young pigs castrated two or three months before slaughter, but they are always more or less noticeable in the case of males that have been castrated late in life, especially in the case of boars that have been in active breeding for several years prior to castration.

These latter (stags) are a most undesirable class of pig from the standpoint of the manufacturer, and Departmental advice is to castrate all boar pigs not required for breeding purposes before they are weaned; run no risk, and utilise the feed to advantage rather than to disadvantage by feeding "old staggy sorts." It is certain that when castration is performed on an animal over three months old it will take much longer to recover, and the loss of condition and subsequent loss of time in fattening are items worthy of careful consideration.

It is interesting to note that before birth, and sometimes for a short time after, the testicles of the pig may be contained within the abdominal cavity. Under normal conditions they pass through comparatively narrow openings at the base of the abdominal cavity and continue through a small canal known as the inguinal canal to the scrotum or purse, pushing ahead of them folds of the lining membrane of the abdominal cavity, known as the peritoneum, which cover or envelope the testicles.

It is well known to all pig breeders that instances occur in which the testicles are not normal. There may be only one testicle showing (either the right or the left side), and in this case it is apparent that only one has descended into the scrotal sac. This is due to some unknown cause and is difficult to understand or describe. Pigs with only one testicle showing are known as "rigs." Their castration is unsatisfactory, for there is the fear that the other testicle will descend into the scrotum later and render a second operation necessary, or, if it does not descend, the animal may become a nuisance as it may become sexually mature or at least partly so.

When to Castrate.

Pigs may be castrated when four to six weeks of age and while they are still suckling the dam, as at that age there is considerably less shock to the nervous system and the growth of the pig will not be checked. A four to six weeks' old pig can be handled conveniently, and the testicles are large enough to render their removal quite simple. The older the pig is the greater the shock and risk and the more severe the after-effects. However, careful observations have indicated that there is no significant difference in the growth rate up to weaning age of a male pig castrated at birth or castrated at five to six weeks of age.

Treatment of Animal, &c., Prior to Operation.

No animal should be castrated without being properly prepared, hence the following rules should be strictly observed in order to avoid unnecessary trouble and loss:—

(1) The animal should be without food for at least six hours before the operation is to be performed. Clean drinking water, however, should be available.

(2) The knife (Plate 89) to be sharpened to razor-edge. Prior to the commencement of the operation and while not in use the knife should be kept in the disinfectant solution.

Plate 89.
KNIFE SUITABLE FOR CASTRATING PIGS.

(3) Select a dry, cool day. Castration should not be done during very cold, windy or rainy weather.

(4) Use a 2-3 per cent. solution of a reliable disinfectant (lysol, sheep-dip, Dettol, &c.)

Antiseptic Oils.

Suitable antiseptic oils for use after castration may be made from the following recipes:—

(1) Mix 1 part of carbolic acid with 10 parts of olive oil;

(2) Dissolve 1 ounce of iodoform in 14 ounces of eucalyptus oil, and when quite clear, add 30 ounces of olive oil.

These oils are in every way preferable to kerosene or other "bush remedies," not only from a humane point of view but because they stimulate the healing processes and repel flies.

The Operation Described.

The operation is best performed by two persons, although good results are being secured by the use of a one-man castration crate (Plates 90-93).

Everything should be in readiness before catching the pig, which should be held firmly on its back (Plate 94) to prevent wriggling and making it difficult for the operator to work. In whatever position the pig is held it must be held firmly, and so that the testicles may be handled freely. The next move is to wash the scrotum or purse and surrounding parts thoroughly with the disinfectant solution (Plate 95).

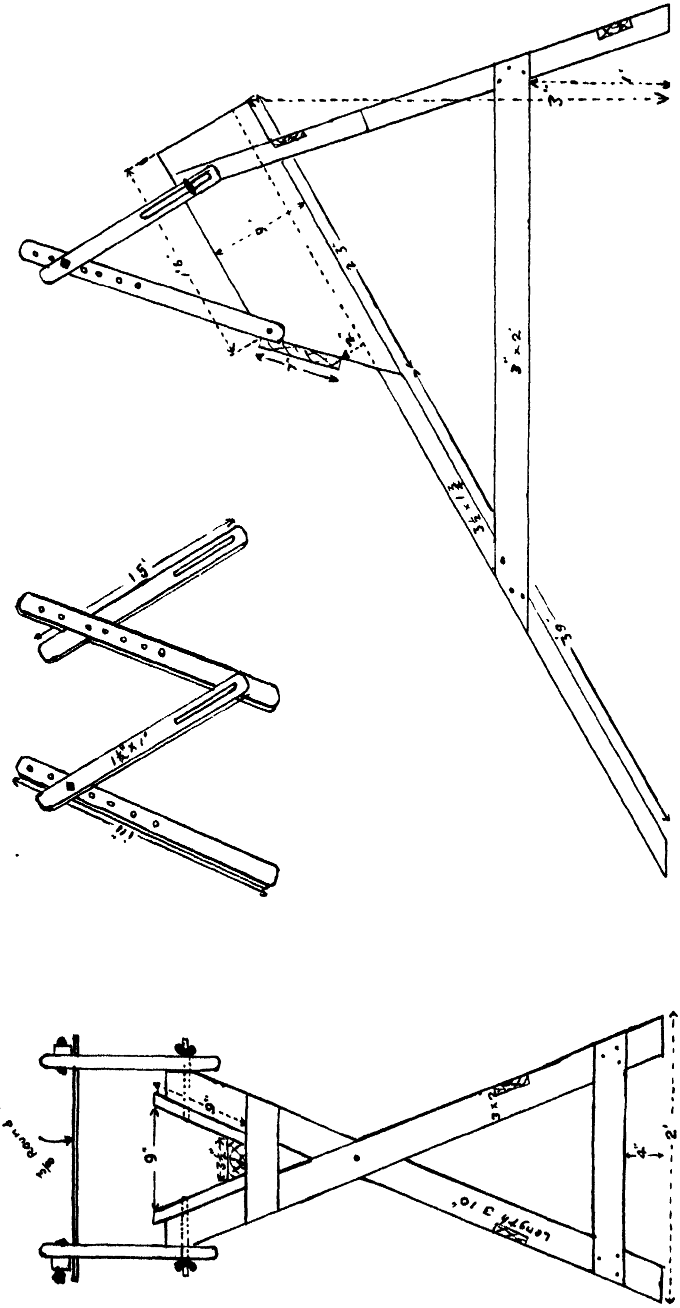


Plate 90.
DIAGRAM OF A CASTRATION CRATE.

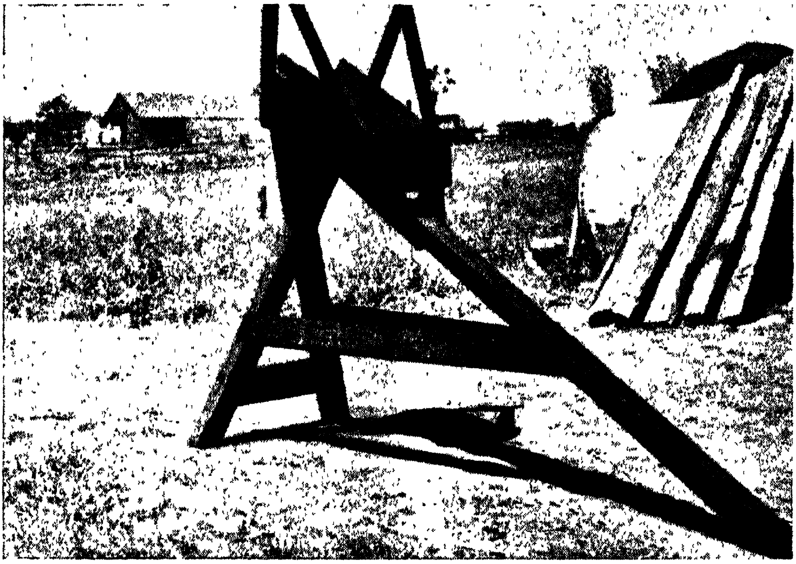


Plate 91.

TWO VIEWS OF THE CASTRATION CRATE OF PLATE 90.

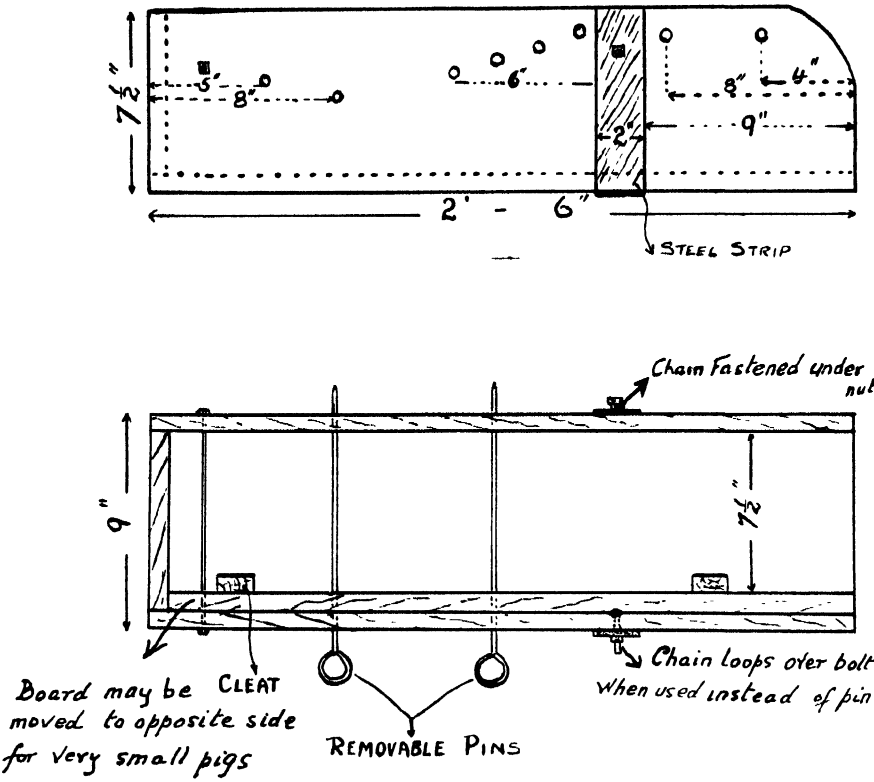


Plate 92.

DIAGRAM OF AN ALTERNATIVE CASTRATION CRATE.

When all is ready the operator seizes one of the testicles between the thumb and forefinger of the left hand, keeping the remaining three fingers closed (Plate 96). An incision is made through the scrotal sac (Plate 97) parallel with the middle line of the body and about half-an-inch to the side of this line, keeping the cuts low, or in such a position that when the animal stands up the blood, &c., will drain away and not collect in the scrotum, as would be the case where the cuts are made high.

The incision should be deep enough to enter the fleshy part of the testicle, thus liberating it from the envelope in which it is normally situated, and long enough to free the testicle without undue pressure and to allow for drainage. Care should be taken to see that the cuts are not made too close, across the middle line of the body or off the surface of the scrotal sac, as this may result in excessive bleeding and soreness.

The testicle is now drawn out and the thin tissue immediately under the testicle cut through, together with the spermatic cord (Plate 98); after which the testicle while being drawn away is scraped (not cut) free from its remaining attachments (Plate 99). The

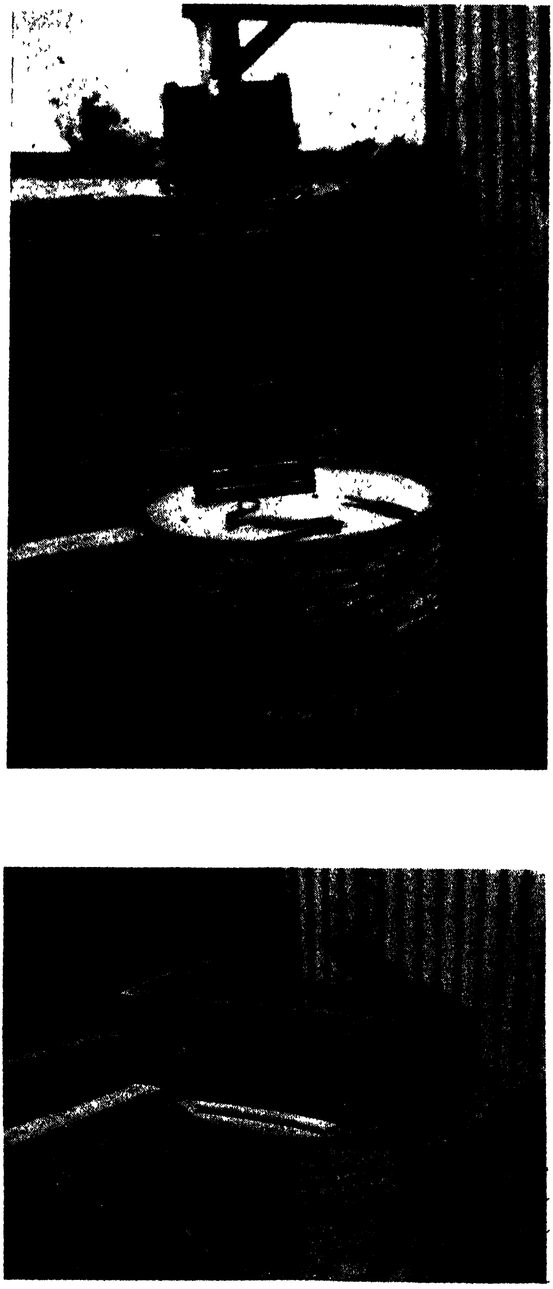


Plate 93.

TWO VIEWS OF THE CASTRATION CRATE OF PLATE 92.

blood vessels should never be cut off abruptly except when the emasculator is used (Plates 100 and 101), as to do so may cause severe haemorrhage. Jerking out the testicle is also dangerous, as it may result in rupture.

The first testicle having been removed, the second one is also taken out in similar manner, but through a second incision made for that particular purpose.

After-treatment and Care.

After the operation is completed (Plate 102), antiseptic oil should be poured into the wounds and the animal placed down, front feet first, to avoid contamination of the wound with dirt, into a clean dry pen or well-covered grass yard.

Complications following proper castration are rare, but when the work is not properly done, the parts not washed, or where the knife is not kept clean, abscess formation (Plate 103) is common. If this occurs, the abscess should be opened at its lowest point with a clean and properly disinfected knife, and the wound syringed out with a warm disinfectant solution, taking care not to use too much pressure. When found necessary, wash the wound twice daily until properly healed, using liberal applications of antiseptic oil each time.

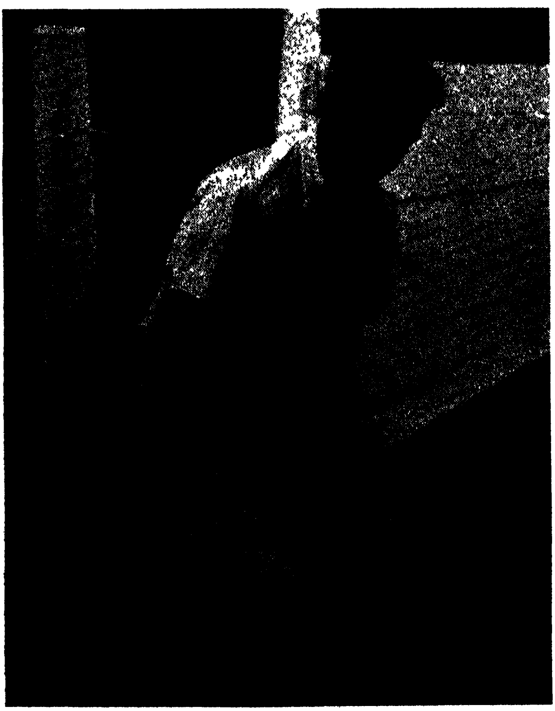


Plate 94.
A METHOD OF HOLDING A YOUNG BOAR.

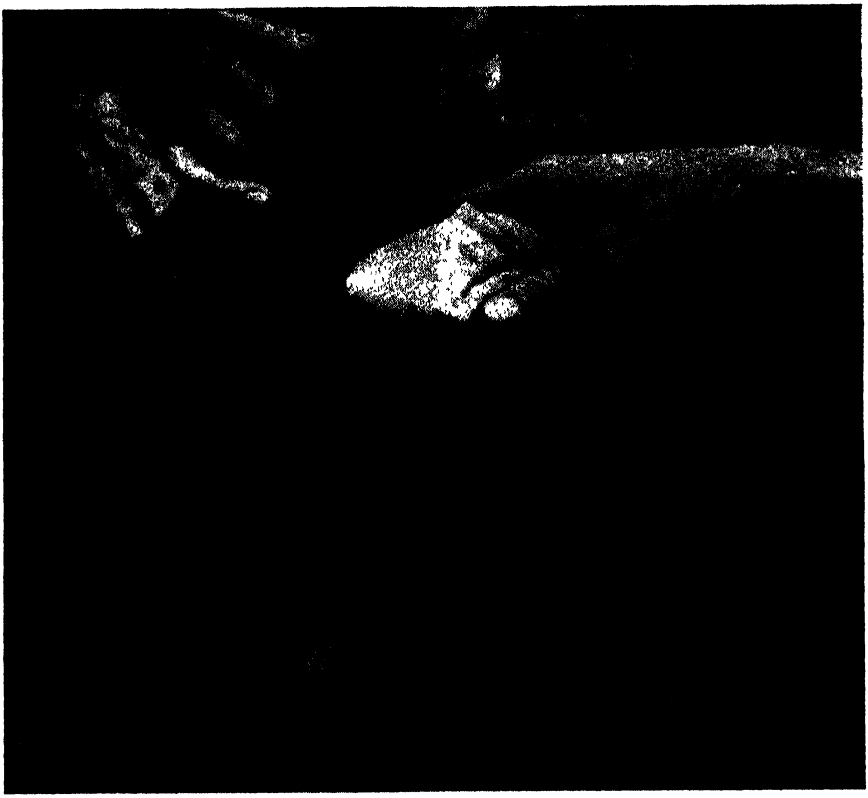


Plate 95.
WASHING THE SCROTUM AND SURROUNDING PARTS PRIOR TO THE OPERATION.

Castration of a Ruptured Animal.

The castration of a ruptured pig is a much more difficult operation than that of a normal animal, and must be performed by the "covered" method. This consists of cutting through the skin of the scrotum alone, the testicle and its covering envelope being taken out in one mass and drawn out as far as possible without undue strain; the cords at the base of the testicles are then tied with silk thread or surgical gut. The testicle is then removed by the aid of the emasculator.

After the second testicle has been removed in a similar manner, three or four stitches should be inserted in the scrotum so as to prevent risk of further rupture.

In the case of young pigs that are ruptured it would pay better to slaughter the animals and use as fresh pork. A veterinary surgeon should certainly perform the operation on a mature boar ruptured late in life.

Plate 96.
SHOWING THE POSITION OF THUMB AND FINGERS WHEN HOLDING THE TESTICLE BEFORE REMOVAL.

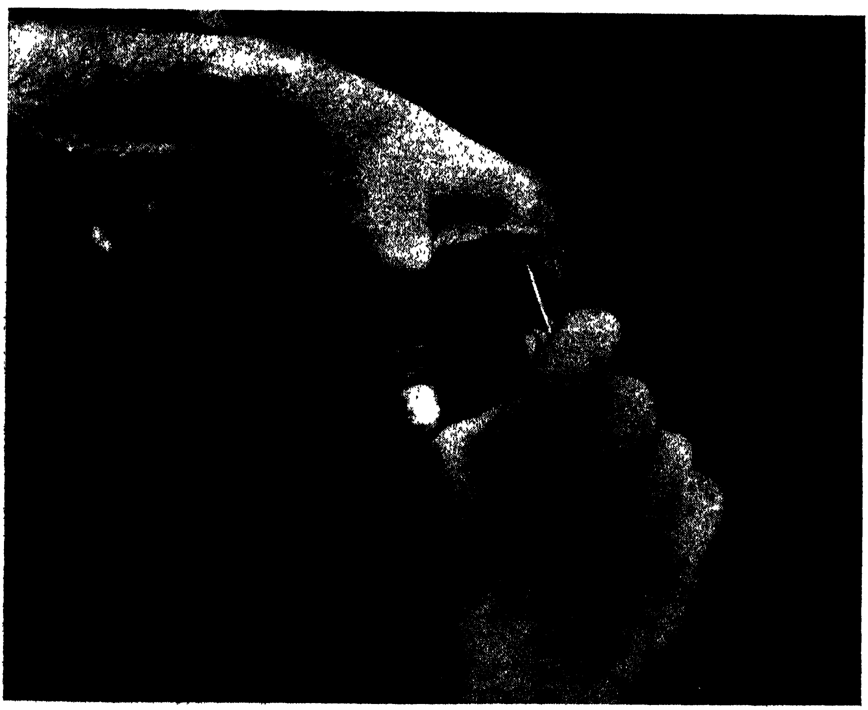


Plate 97.
SHOWING TESTICLE FIRMLY HELD IN THE SAC AND THE KNIFE IN POSITION READY TO MAKE THE INCISION.

Plate 98.
CUTTING THROUGH THE THIN TISSUE BEFORE SCRAPING THE TESTICLE FREE.

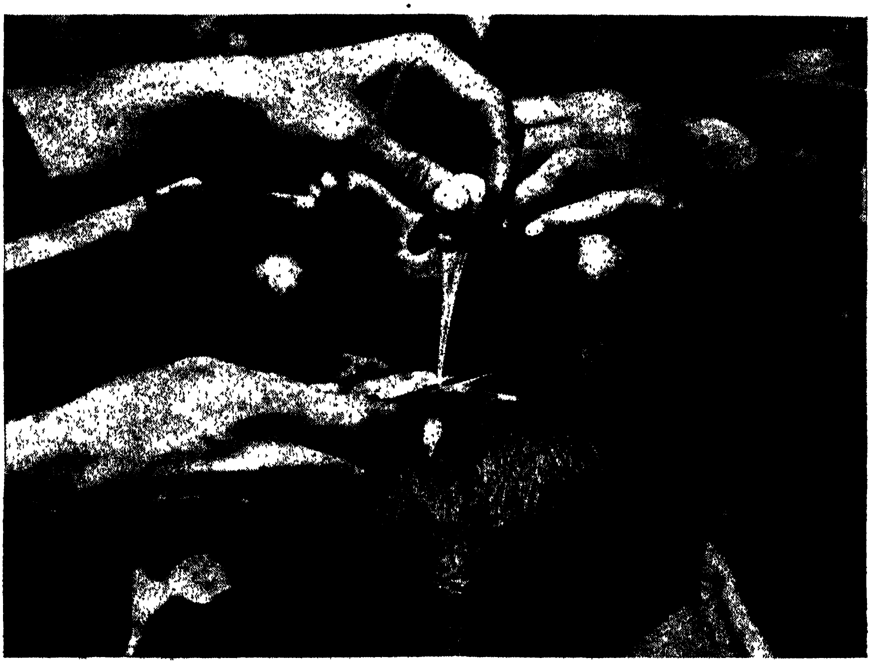


Plate 99.
SHOWING THE TESTICLE DRAWN OUT AND THE CORD BEING SCRAPED.

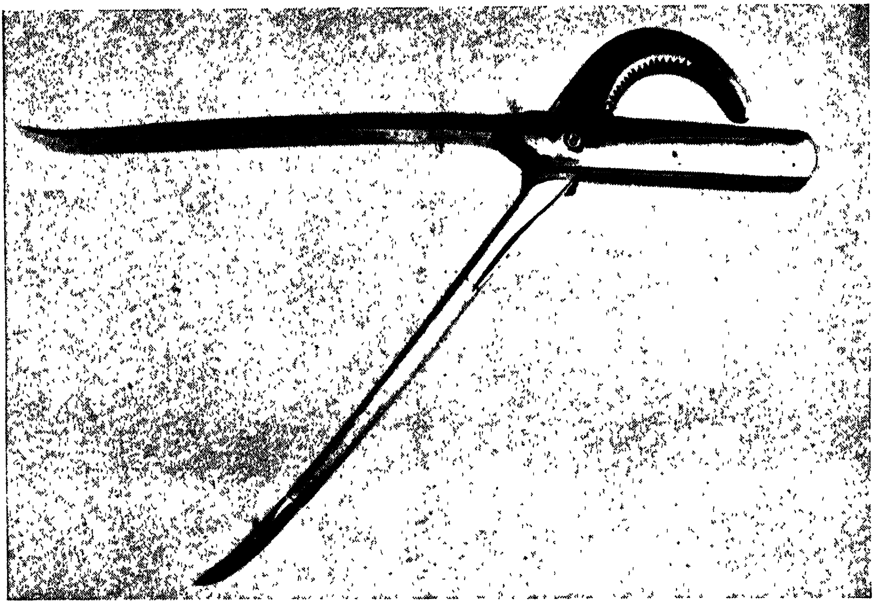


Plate 100.
AN EMASCULATOR FOR USE ON AGED BOARS.

Plate 101.
USING THE EMASCULATOR AS IN THE CASE OF A WELL-GROWN BOAR.

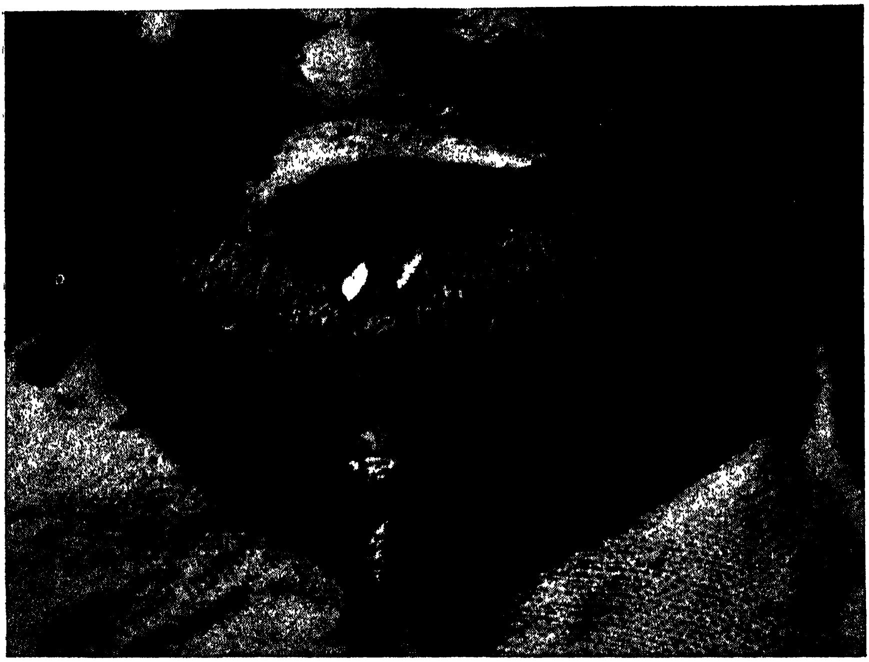


Plate 102.
SHOWING THE OPERATION COMPLETED.

Plate 103.
ABSCESSED AREAS RESULTING FROM INCORRECT CASTRATION.

ASTRONOMICAL DATA FOR QUEENSLAND.

MAY

Supplied by W. J. Newell, Hon. Secretary of the Astronomical Society of Queensland.

TIMES OF SUNRISE AND SUNSET.

At Brisbane.			MINUTES LATER THAN BRISBANE AT OTHER PLACES.					
Day.	Rise.	Set.	Place.	Rise.	Set.	Place.	Rise.	Set.
	a.m.	p.m.						
1	6.13	5.17	Cairns	12	46	Longreach	28	42
6	6.16	5.13	Charleville ..	25	29	Quilpie	36	34
11	6.19	5.09	Cloncurry	38	61	Rockhampton ..	2	18
16	6.21	5.06	Cunnamulla ..	30	28	Roma	16	18
21	6.24	5.04	Dirranbandi ..	21	17	Townsville ..	11	38
26	6.27	5.02	Emerald	13	26	Winton	31	50
31	6.29	5.00	Hughenden ..	23	47	Warwick	5	4

TIMES OF MOONRISE AND MOONSET.

At Brisbane.

Day.	Rise.	Set.
	a.m.	p.m.
1	8.43	7.06
2	9.43	7.56
3	10.41	8.53
4	11.35	9.56
	p.m.	
5	12.23	11.01
6	1.06	..
		a.m.
7	1.45	12.07
8	2.21	1.12
9	2.56	2.17
10	3.31	3.23
11	4.07	4.29
12	4.48	5.38
13	5.33	6.48
14	6.24	7.58
15	7.22	9.04
16	8.22	10.04
17	9.23	10.56
18	10.22	11.41
		p.m.
19	11.20	12.19
20	..	2.52
	a.m.	
21	12.15	1.21
22	1.07	1.48
23	1.59	2.15
24	2.50	2.42
25	3.43	3.11
26	4.38	3.43
27	5.35	4.20
28	6.35	5.02
29	7.35	5.52
30	8.35	6.48
31	9.31	7.49

MINUTES LATER THAN BRISBANE (SOUTHERN DISTRICTS).

Charleville 27; Cunnamulla 29 Dirranbandi 19;
Quilpie 35; Roma 17; Warwick 4.

MINUTES LATER THAN BRISBANE (CENTRAL DISTRICTS).

Day.	Emerald.		Longreach.		Rockhampton.		Winton.	
	Rise.	Set.	Rise.	Set.	Rise.	Set.	Rise.	Set.
1	10	30	25	45	0	21	27	53
6	12	26	27	42	2	17	30	49
11	24	15	40	31	15	6	46	35
16	30	9	46	23	21	1	54	26
21	24	15	40	31	15	7	46	35
26	13	26	29	42	3	17	32	49
31	9	30	25	45	0	21	26	53

MINUTES LATER THAN BRISBANE (NORTHERN DISTRICTS).

Day.	Cairns.		Cloncurry.		Hughenden.		Townsville.	
	Rise.	Set.	Rise.	Set.	Rise.	Set.	Rise.	Set.
1	5	55	35	67	19	52	5	45
3	2	56	33	67	17	53	3	46
5	7	50	36	63	20	49	7	42
7	17	45	41	60	26	46	15	37
9	28	33	50	54	34	38	24	29
11	41	20	57	44	42	29	34	18
13	52	8	66	36	50	21	43	8
15	56	2	68	32	52	17	46	3
17	53	4	67	33	50	19	44	5
19	44	11	61	38	45	23	37	11
21	40	21	57	44	42	29	33	18
23	30	31	51	51	35	36	25	26
25	20	40	43	58	28	43	17	34
27	10	49	37	63	22	49	9	41
29	3	56	34	67	18	53	4	46
31	2	55	33	67	17	52	3	45

Phases of the Moon.—First Quarter, May 6th, 7.33 a.m.; Full Moon, May 12th, 10.51 p.m.; Last Quarter, May 20th, 5.22 a.m.; New Moon, May 28th, 8.24 a.m.

On May 12th the Sun will rise and set 20 degrees north of true east and true west respectively, and on the 10th and 23rd the Moon will rise and set at true east and true west respectively.

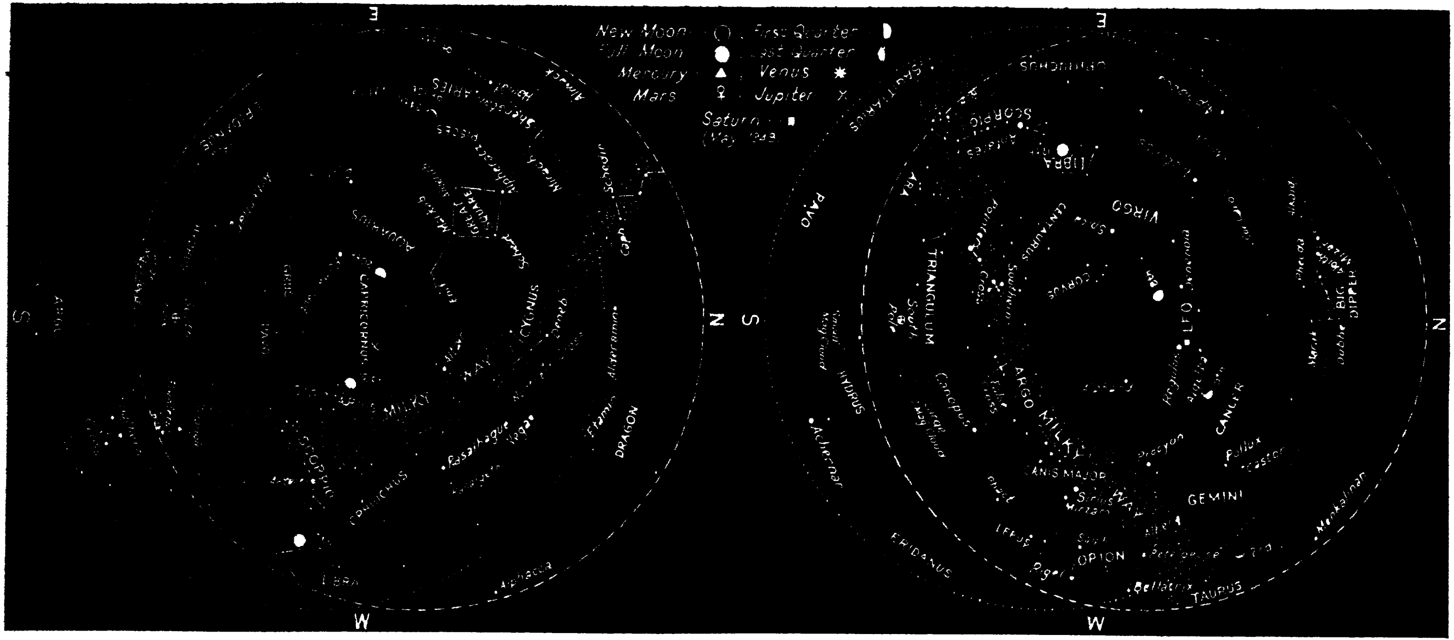
Mercury.—On the 1st, in the constellation of Taurus will set about 1 hour after sunset, and after reaching greatest angle east of the Sun on the 10th, when it will set 1 hour 10 minutes after the Sun, it will appear stationary on the 23rd, after which it will begin to approach the Sun and by the end of May will set less than half-one hour after Sunset. On the 27th it will pass less than one degree to the south of Venus.

Venus.—Too close to the Sun for observation at the beginning of the month but towards the end of the month, in the constellation of Taurus may be seen low in the west during evening twilight.

Mars.—In the constellation of Aries, will rise 45 minutes before the Sun at the beginning of the month and about 1¾ hours before the Sun at the end of the month.

Jupiter.—Now rising a couple of hours before midnight, in the constellation of Capricornus. By the end of May it will rise between 8.45 p.m. and 10 p.m.

Saturn.—In the constellation of Leo, not far from Regulus, will rise during the afternoon daylight hours, and by the end of the month will have reached the western section of the sky by nightfall. On the 31st it will set between 11 p.m. and midnight.



Star Charts.—The chart on the right is for 7.15 p.m., in the south-east corner of Queensland, to 8 15 p.m. along the Northern Territory border on the 15th May. (For every degree of longitude we go west, the time increase by 4 minutes) The chart on the left is for 10 hours later On each chart the dashed circle is the horizon as viewed from Cape York and the dotted circle is the horizon for places along the New South Wales border. When facing North hold "N" at the bottom; when facing South hold "S" at the bottom and similarly for the other directions. Only the brightest stars are included and the more conspicuous constellations named. The stars which do not change their relation to one another, moving east to west, arrive at any selected position about 4 minutes earlier each night. Thus, at the beginning of the month the stars will be in the positions shown about 1 hour later than the time stated for the 15th and at the end of the month about 1 hour earlier than that time. The positions of the moon and planets, which are continually changing in relation to the stars, are shown for certain marked days. When no date is marked the position is for the middle of the month.

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Contents

Notes on Agriculture in the United States.*

C. J. McKEON, Director of Agriculture.

Grain Sorghum.

DURING the war years the dwarf grain sorghums, which can be mechanically harvested, came into prominence in the United States, and this crop is now of considerable importance in Texas, Kansas, Oklahoma, California, Colorado, New Mexico, Arizona and other States.

As late as 1941 only 10 per cent. of the total grain sorghum acreage was planted to types which could be harvested with a combine, or header, as it is known in Australia, but this had increased to 90 per cent. in 1946, in which year the production of grain sorghum in Texas alone was 74,000,000 bushels.

The leading varieties now being grown are Martin (a selection from Wheatland), which matures in 95 days; Plainsman (a milo x kafir cross), which matures in 100 to 105 days; and Caprock (another milo x kafir cross), which matures in 105 to 115 days. Caprock is somewhat similar to Plainsman, the main difference being the period of maturity. Martin and Plainsman are under test in Queensland.

The original Kalo and Wheatland types, which have been so widely grown here, are now only grown to a limited extent in the United States, where the main Kalo selection is known as Midland.

Hegari, another variety which has done very well in parts of Queensland, is still grown fairly extensively in southern Texas, where a new strain called Early Hegari has given very good results. It is two weeks earlier than Hegari, and like the original Hegari is more palatable to stock as a green fodder than most other grain varieties.

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* These notes on various crops have been taken from a report prepared by Mr. McKeon following a visit to the United States as a member of a committee investigating the soy bean industry.

At Lubbock Experiment Station, Texas, sorghum breeding work is conducted on a most extensive scale and some particularly fine kafir x shallu hybrids are under observation (Plates 104–106). One of these, which is a dwarf type but has a characteristic shallu type of head (Plates 105 and 106), has been released for general cultivation. It still is lacking somewhat in uniformity, but having such an open type of head should ultimately prove an ideal type to withstand grub attack.

Work is also in progress at Lubbock on Cody, a variety with a grain which has a waxy endosperm. Large quantities of waxy endosperm grains have been used in the United States for the manufacture of a tapioca substitute in recent years.

Sweet Sudan Grass.

This variety was evolved at the Texas Agricultural Experiment Station, in co-operation with the Bureau of Plant Industry, United States Department of Agriculture, after several years' work. The variety is the result of a cross between a sweet sorghum, Leoti, and Sudan grass, the desire being to incorporate the sweet, juicy stalk and the sienna-coloured glumes of Leoti into the grass and at the same time retain the grassy characteristics of the latter. Because of the very close resemblance of Sudan grass seed to Johnson grass seed, it is often not possible for farmers to be sure they are not introducing Johnson grass to their properties when buying Sudan grass seed. The distinctive glume colour of the new variety renders it readily distinguishable from Johnson grass or common Sudan grass.

It was claimed that in feeding trials conducted in Texas stock not only showed a marked preference for Sweet Sudan grass but grazed it to the ground, while the common Sudan grass was grazed only to a height of one foot from the ground.

Leoti, the sweet sorghum parent, is resistant to several leaf diseases which attack Sudan grass in coastal areas. Sudan grass has proved very susceptible to leaf diseases in coastal districts of Queensland, also, and for that reason is rarely grown in those districts. It is claimed that most of the resistance possessed by Leoti has been transmitted to Sweet Sudan grass. The new variety, however, is not wholly resistant to leaf diseases and work is in progress to endeavour to correct that deficiency.

Rice.

Rice production was seen in several States. Though the most modern methods are used for the production of the crop, yields, even in the States which have the highest yields per acre, are much below Australian figures. Surprise was expressed, even on research stations, when those associated with the industry were informed of the high yields that were obtained in Australia.

At the University of Arkansas Rice Branch Experiment Station, breeding work is concentrated largely on the production of types which

are resistant to stem rot and 80 different selections were undergoing trials at the time of my visit. This disease is responsible at times for losses of up to 50 per cent.

At the Arkansas station, it was stated, 31 inches are required to bring a crop to maturity—10 inches from natural rainfall and 21 inches supplied by irrigation. The cost of applying the water is from 10 to 12 dollars per acre.

Approximately half of the rice produced in Arkansas is of a medium grain variety, Zenith. A new long grain variety named Prelude is now gaining popularity. The average yield in Arkansas is 50 bushels per acre.

In some of the large rice producing districts, aeroplanes are used for sowing the seed, and this is being done with remarkable accuracy. Aircraft are capable of sowing from 300 to 500 acres a day and each machine earns up to 500 dollars a day. The rice seed is distributed through a chute at the bottom of the plane (Plate 107) and it is claimed that it is distributed as evenly as if sown with a seed drill. Apart from the speed with which sowing is carried out, an added advantage is that the seed is sown directly on to the flooded land. With the normal method of sowing, the land would of necessity have to be dry on the surface to carry the seed drills and flooding would have to be carried out after seeding had been completed.

On one property which was visited in California, 600 acres were under rice, all of which had been sown by aeroplane. Costs of production on this property were approximately 80 dollars per acre. A yield of 30 to 35 cwt. per acre would be considered a good one.

Harvesting is carried out before the grain is quite dry, as it has been found that the high moisture content reduces cracking of the grain during harvesting (Plates 108 and 109). The grain is taken from the headers to drying plants, where the moisture content is reduced to 14 per cent. Two types of driers were seen in operation, one in which the loose grain is passed through blasts of hot air and the other in which the bagged grain is laid on small openings and hot air is forced up through the bags from underground chambers (Plate 110).

Maize.

Practically all maize grown for grain in the chief maize producing States is now hybrid maize, only a very small percentage being the open pollinated varieties.

The average annual acreage sown to maize in the United States is 90,000,000, and as the bulk of this is sown with hybrid seed the production of hybrids is now carried out on a very extensive scale. Several private concerns produce the seed on a large scale, each having its own farms on which the seed is produced. The firms concerned also have their own highly trained plant breeders to carry out the breeding work.

Maize yields for the whole of the Corn Belt are high, and this applies particularly to some of the chief producing States, such as Illinois, where the average yield has not been below 40 bushels per acre for the past 10 years. This is a remarkably high yield when it is considered that the average acreage sown each year is over 8,000,000.

Rainfall during the growing period is very reliable and is particularly well distributed, and it is only in a very exceptional season that high yields per acre are not obtained.

Since the use of hybrid seed has increased, yields have shown a consistent improvement.

Although there are quite a number of different hybrids offered for sale in Illinois, most of the leading hybrids are very closely related, as will be noted from the following pedigrees:—

U.S. 13	(Hy x L317) (WF9 x 38-11)
Illinois 21	(WF9 x 38-11) (Hy x 187-2)
Illinois 200	(WF9 x 38-11) (K4 x L317)
Illinois 201	(WF9 x 38-11) (187-2 x L317)

It will be noted that there is only one inbred line difference in the pedigrees of nearly all of these.

The cost of hybrid seed is approximately 10 dollars per bushel.

Although there are different makes of pickers on the market, the bulk of the United States maize crop is still hand-harvested. The crops in the Corn Belt were not sufficiently mature to witness any of the pickers operating in those States, but one was seen operating on a light crop in California (Plates 111 and 112). This machine performed fairly well under very favourable conditions.

Kudzu.

After travelling through most of the agricultural States, the opinion was formed that this plant is not nearly as extensively grown in the United States as many press articles would indicate. It has been found in that country that the plant only thrives in areas in which there is a moderate rainfall and where extremes of temperatures do not occur. It has also been found that the plant does not thrive in tropical high-rainfall areas. This has been the experience at South Johnstone in this State, where the plant has been under trial for a number of years. At no time has it made the prolific growth under tropical conditions that has been made by its relative, tropical kudzu.

Plate 113, which shows kudzu in Louisiana, will give an indication of how this plant thrives under suitable climatic conditions.

Plate 104.

GRAIN SORGHUM.—At right, a shallu variety, height 88 inches. At left, a shallu hybrid, height 58 inches.

Plate 105.

GRAIN SORGHUM.—A dwarf shallu hybrid.

Plate 106.
GRAIN SORGHUM.—A close view of a dwarf shallu hybrid.

Plate 107.
RICE SOWING.—A view of the chute through which aerial sowing is carried out.

Plate 108.
A RICE HARVESTER IN OPERATION.

Plate 109.
A NEW TYPE OF RICE HARVESTER.

Plate 110.
RICE DRYING.—Hot air is being forced through the bags from underground chambers.

Plate 111.
MAIZE HARVESTING.—A front view of a machine in operation.

Plate 112.
MAIZE HARVESTING.—A rear view of the machine shown in Plate 111.

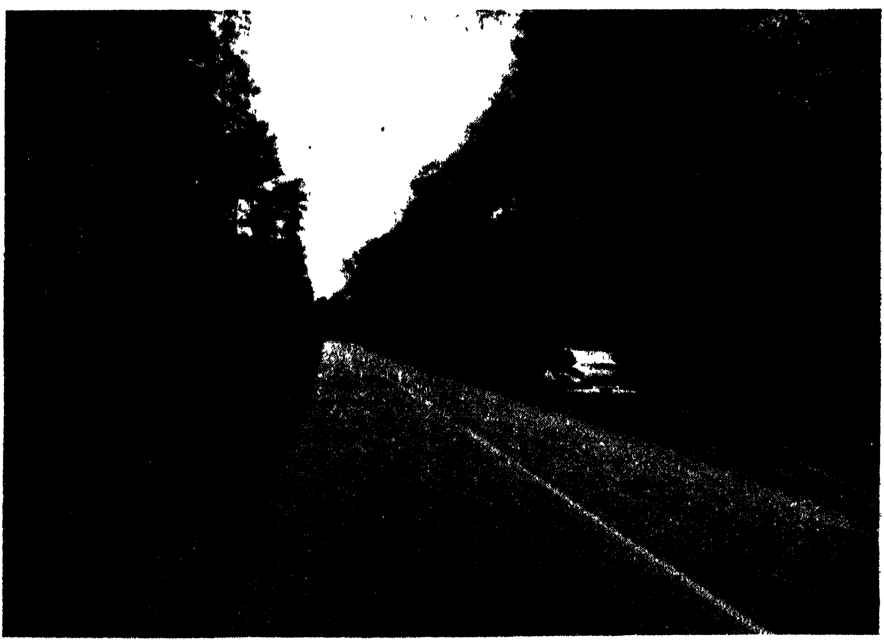

Plate 113.
KUDZU GROWING OVER TREETOPS.

Restoring the Productivity of Worn-out Tobacco Soils in the Miriam Vale District.

W. J. CARTMILL, Senior Soils Technologist, and R. A. TARRANT, Senior Adviser in Agriculture.

TOBACCO is grown in the Miriam Vale district under rainfall on light sandy and sandy loam soils derived from granite. As is frequently the case with soils of this nature, they are naturally of low fertility; but they are well suited to the production of bright flue-cured tobacco since the plant food status can be adjusted to the proportions required for this purpose by proper fertilization. Satisfactory yields are to a large extent dependent upon a steady supply of available soil moisture during the growing period and, since the water-holding capacity of the top-soil is low, it is desirable that the subsoil should be of heavier texture so that it will retain a greater quantity of water from which the plant can obtain its water requirements after the top soil has dried out.

Though the characteristics of the Miriam Vale soils class them as suitable for tobacco growing, it has been the experience of most growers that the soils will produce only one satisfactory crop of tobacco after they have been broken up. Attempts to utilise land which had previously grown tobacco have not met with much success even in cases where the land has been rested for four or five years. The second crop makes a stunted and irregular growth and usually becomes severely infested with nematodes. As a consequence the general practice has been to grow the tobacco crop only on virgin soils. New land is cleared each year and often the old fences are removed and re-erected around the areas of newly-cleared land. This practice greatly adds to the cost of production and restricts the growing of the crop to the availability of virgin land. By 1945 the position in regard to the availability of new land had become acute and at the request of growers investigations were then commenced on the problem of restoring the productivity of the old soils.

CAUSES OF UNPRODUCTIVENESS.

Early investigations indicated that undoubtedly one of the principal causes of unproductiveness was nematode infestation of the old land. Past experience had shown that in nearly all cases where tobacco had been planted on old land the crop became heavily infested with this pest. Nevertheless, poor and irregular growth was known to occur amongst crops showing only slight nematode infestation and it was considered that the effects of the nematodes were made severe because the plants failed to make satisfactory early growth. It is probable, therefore, that a nutritional factor is involved in the first instance. Examinations of the soils in the field suggested that the organic matter content had been depleted by cultivation. The soils on the worn-out areas showed a greater degree of compaction than neighbouring virgin soils and sometimes a lightening in colour. There was also evidence that erosion had occurred on some paddocks and in places had removed all the top soil.

Inquiry into the treatment applied to the old land following the removal of the tobacco crop revealed that the general practice was to remove the fences and allow stock free access to the areas. As a consequence of this practice only a very scanty cover of weeds and grasses established itself, and the areas virtually remained bare. It is probable that stock selectively grazed these areas because of the greater palatability of the grass shoots as a consequence of the soil containing residual supplies of fertilizer which had been applied for the tobacco crop. At all events, the grass cover on these areas always seemed to be particularly poor, which led to the general belief that the soil had become too poor to grow grass or any other crop.

IMPORTANCE OF ORGANIC MATTER.

When organic matter thoroughly decomposes it forms humus. Humus is a highly colloidal substance and because of its porosity it raises the water capacity of a soil to a marked degree. It also has a high absorptive capacity for mineral plant foods and stores these in the soil against the effects of leaching. Small increases of humus in the soil have a marked effect upon the physical properties of the soil far in excess of their proportionate amounts. Its important role in light-textured soils growing crops under rainfall is therefore apparent. There is also evidence that the harmful effects of nematodes are often markedly reduced by the addition of organic matter to soils, a factor of considerable importance in the case of the soils in question. Large quantities of crop residues are required to build up the organic matter appreciably in soils, and since these are usually not readily available they must be produced on the spot over a period of time. It has been found that one of the best ways of doing this in a relatively short time is to grow a dense grass cover on the soil and allow it to remain there for a few years. The matted root system of the grass, by its simultaneous growth and decay, adds steadily to the soil an appreciable quantity of organic matter within a year or two.

ROTATIONS PRACTISED.

To restore the productivity of these soils it was clear that some form of rotational cropping would have to be adopted. As the principal aim was to build up depleted supplies of organic matter, it was decided that grasses and legumes should form the basis of the rotations. Although it was felt that a long-term rotation would probably be necessary to restore the productivity to a satisfactory level, it was decided to work on a two-year and a three-year rotation because of the urgency of the problem and because it was considered that some indication of the value of the rotations could be obtained in three years, if not in two. Nevertheless, it was decided that the emphasis should be on the longer rotation.

The grasses chosen for trial were the summer-growing perennial Rhodes grass and the annual Sudan grass, and the legumes were the perennial centro* and the annuals Gambia pea† and velvet beans. In addition, native grasses and weeds developed from volunteer growth were included as a treatment.

* *Centrosema pubescens.*

† *Crotalaria goreensis.*

It was decided that the investigations should be conducted as demonstration plots and that each plot should be fairly large so that all operations could be conducted on a practical scale. It was arranged that the growers who co-operated in these trials would attend to all the cultural operations and the harvesting and curing of the leaf. A 5-acre area which growers agreed was a typical sample of the worn-out lands and which had not grown tobacco for five years was selected, fenced, and divided into 10 plots each one-half acre in extent. The following rotations were commenced on the 10 plots in November, 1945:—

Plot No.	First Season (1945-46.)	Second Season (1946-47)	Third Season (1947-48).
1	Native weeds and grasses	Tobacco	Tobacco
2	Native weeds and grasses	Native weeds and grasses	Tobacco
3	Centro	Rhodes grass	Tobacco
4	Centro	Centro	Tobacco
5	Gambia pea	Gambia pea	Tobacco
6	Rhodes grass	Rhodes grass	Tobacco
7	Sudan grass	Gambia pea	Tobacco
8	Gambia pea	Tobacco	Tobacco
9	Velvet beans	Tobacco	Tobacco
10	Tobacco	Rhodes grass	Tobacco

These rotations were planned after deciding to make the following the main features of the trials:—

(*a*) The principal rotations to be on the basis of a three-year period, with tobacco following two years under grass and/or legumes.

(*b*) Tobacco to be followed by tobacco in some of the short-term rotations to determine the extent of the decline in productivity.

(*c*) One plot to be planted to tobacco in the first season to determine if the land would not grow a satisfactory crop of tobacco in its existing state, as had been claimed.

(*d*) The whole area to be under tobacco in the third season.

As it was important to ensure that the various crops should be given every opportunity to establish themselves satisfactorily in the first season, the land was ploughed and harrowed and fertilized with a moderate dressing of a complete fertilizer mixture, excepting Plots Nos. 1 and 2, which were only topdressed with fertilizer.

TREATMENTS AND RESULTS.

Though all the treatments for the first season were established according to plan it soon became apparent that some were very promising and that others would not be successful. Rhodes grass flourished from the start and formed a dense stand. The native grasses were slow to close in but eventually a fairly dense stand of mixed species, but principally of bunch spear grass,* was developed. Sudan grass died out early and creeping summer grass† took possession of the plot. Gambia pea grew vigorously and formed a good cover where the stand

* *Heteropogon contortus.*

† *Digitaria* sp.

was satisfactory. Centro made slow growth and for a time native grasses dominated those plots. Velvet beans failed early and creeping summer grass took possession of that plot also. The tobacco on Plot No. 10 failed to make much headway, and though some individual plants made good growth the plot was written off as a failure. This result substantiated the claim made by growers regarding the low productivity of the land in relation to tobacco.

Details and results of the various rotations are as follows:—

Plot No. 1.

1945-46 *Season.*

Topdressed with 240 lb. of mixed fertilizer (4·5 :12·0 :4·5).

Native grasses and weeds, consisting mainly of bunch spear grass, with creeping summer grass, crowsfoot* and horse weed,† were permitted to grow. A good cover was established after a slow initial growth.

Plate 114.

TOBACCO FOLLOWING ONE YEAR OF NATIVE GRASSES (PLOT 1, 1946-47).

1946-47 *Season.*

Grasses ploughed under. Fertilized with a 4 :12 :6 mixture at the rate of 480 lb. per acre and planted to tobacco. Yield = 625 lb. of cured leaf per acre. (See Plate 114.)

1947-48 *Season.*

Fertilized as before and again planted to tobacco. Plants stunted and badly infested with nematode. Crop considered a failure.

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* *Eleusine indica.*

† *Erigeron* sp.

Plot No. 2.

1945-46 *Season.*

Same as for Plot No. 1.

1946-47 *Season.*

The grasses and weeds made good growth and formed a dense cover. (See Plate 115.)

1947-48 *Season.*

Grasses and weeds ploughed under. Area fertilized with 4:12:6 mixture at the rate of 480 lb. per acre, and planted to tobacco. The strike was poor, but subsequent growth good. Difficulty was experienced

Plate 115.

RIGHT.—NATIVE GRASSES AFTER TWO YEARS (PLOT 2, 1946-47).
LEFT.—RHODES GRASS FOLLOWING CENTRO AND SUMMER GRASS (PLOT 3, 1946-47).

in rotting the grass, which had grown tall and rank and did not plough under well. It was because of these conditions that the resultant strike was poor.

Yield = 325 lb. of cured leaf per acre. (See Plate 116.)

Plot No. 3.

1945-46 *Season.*

Fertilized with 240 lb. of a 2:15:4 mixture and sown to centro. A poor strike resulted and subsequent growth was slow. Eventually a dense growth of summer grass took possession though the centro plants persisted.

1946-47 *Season.*

The mixed stand of summer grass, centro and crowsfoot was ploughed in and the plot sown to Rhodes grass. A dense growth of Rhodes grass resulted. (Plate 115.)

1947-48 *Season.*

The Rhodes grass was ploughed in, and the plot fertilized with 4:12:6 mixture at the rate of 480 lb. per acre and planted to tobacco. The crop grew well and excellent quality leaf was produced. Yield of cured leaf = 632½ lb. per acre.

Plot No. 4.

1945-46 *Season.*

Fertilized and sown to centro, as for Plot No. 3. The strike was only fair and the growth of the legume slow, and summer grass invaded the plot.

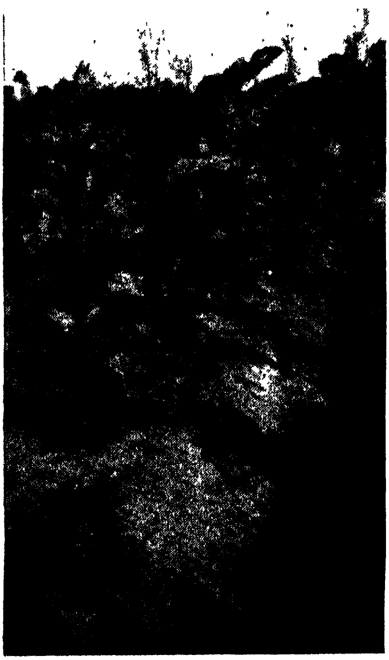

Plate 116.

TOBACCO FOLLOWING NATIVE GRASSES FOR TWO YEARS (PLOT 2, 1947-48).

Plate 117.

TOBACCO FOLLOWING GAMBIA PEA FOR TWO YEARS (PLOT 5, 1947-48).

1946-47 *Season.*

The centro made further growth and eventually a thick cover of summer grass and centro was developed.

1947-48 *Season.*

The grass-legume mixture was ploughed under and the plot planted to tobacco after fertilizing with 4:12:6 mixture at the rate of 480 lb. per acre. A good crop of high quality leaf was produced, yielding 731½ lb. of cured leaf per acre.

Plot No. 5.

1945-46 *Season.*

Fertilized with 240 lb. of a 2:15:4 mixture and Gambia pea sown broadcast. An excellent crop resulted, which seeded freely.

1946-47 *Season.*

The plot was given no further treatment. A second crop of Gambia pea grew from the seed of the first crop as well as from the base of the old plants, and a dense growth resulted.

1947-48 *Season.*

The Gambia pea was ploughed under and decomposed readily. After fertilizing with a 4 : 12 : 6 mixture at 480 lb. per acre the plot was planted to tobacco. The crop grew well and yielded 924 lb. of cured leaf per acre. (See Plate 117.) The quality of the leaf was very good.

Plot No. 6.

1945-46 *Season.*

Fertilized with 240 lb. of a 4·5 : 12·0 : 4·5 mixture and Rhodes grass sown broadcast. The grass became well established and a dense cover developed. It seeded freely.

Plate 118.
RHODES GRASS AFTER TWO YEARS (PLOT 6, 1946-47).

1946-47 *Season.*

A dense cover of Rhodes grass was maintained without further treatment. (See Plate 118.)

1947-48 *Season.*

The grass was ploughed under and the area prepared for tobacco. It was fertilized with 4 :12 :6 mixture at the rate of 480 lb. per acre. The grass was somewhat slow to decompose, with the result that only a fair strike of tobacco was obtained. The subsequent growth was very good and the resultant yield of 742½ lb. per acre of cured leaf must be considered very good under the circumstances. (See Plate 119.)

Plot No. 7.

1945-46 *Season.*

Fertilized with 240 lb. of a 4·5 : 12·0 : 4·5 mixture, and Sudan grass sown broadcast. The crop did not thrive and eventually died out. Late in the season the plot was reploughed and sown to Rhodes grass, but because of dry conditions the germination was poor.

Plate 119.
TOBACCO FOLLOWING RHODES GRASS FOR TWO YEARS (PLOT 6, 1947-48).

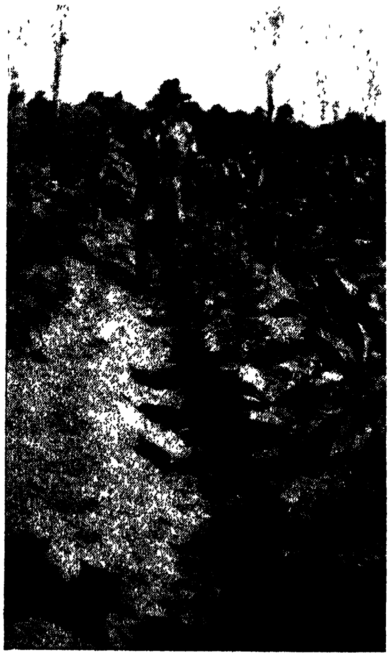

Plate 120.
TOBACCO FOLLOWING TOBACCO (PLOTS 8, RIGHT, AND 9, LEFT, 1947-48).

1946-47 *Season.*

The plot was sown to Gambia pea without any further preparation and a good strike and excellent growth resulted.

1947-48 *Season.*

The Gambia pea was turned under and the area prepared for tobacco. It was fertilized with 4:12:6 mixture at the rate of 480 lb. per acre. The tobacco crop yielded 847 lb. per acre of good quality leaf.

Plot No. 8.

1945-46 *Season.*

Fertilized with 240 lb. of a 2:15:4 mixture, and sown to Gambia pea. Only a fair strike resulted and, because of the fairly thin stand of legume, summer grass invaded the plot and was choking out the legume when the mixture of legume and grass was ploughed in late in the season and the plot sown to Rhodes grass. Because of drought the germination of Rhodes grass was very poor.

1946-47 *Season.*

The plot was ploughed, and prepared for tobacco. It was fertilized with 4:12:6 mixture at the rate of 480 lb. per acre before planting. A very satisfactory yield of 742½ lb. of cured leaf per acre was harvested. (See Plate 121.)

1947-48 *Season.*

The plot was again planted to tobacco after fertilizing with 4:12:6 mixture at the rate of 640 lb. per acre. The growth was very poor and the yield of cured leaf was only 165 lb. per acre. Nematode infestation was severe. (See Plate 120.)

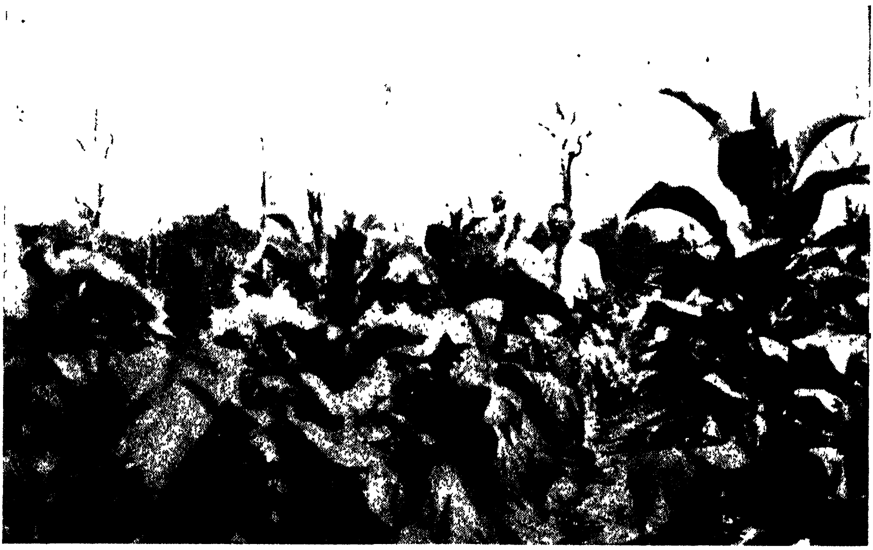

Plate 121.

TOBACCO FOLLOWING GAMBIA PEA AND SUMMER GRASS FOR ONE YEAR (PLOT 8, 1946-47).

Plot No. 9.

1945-46 *Season.*

Fertilized with 240 lb. of 2:15:4 mixture and velvet beans sown in drills 4 feet apart. Shortly after germinating the plants gradually died off and eventually the plot became a mass of creeping summer grass.

1946-47 *Season.*

The grass was ploughed in and the plot prepared for tobacco. It was fertilized with 4:12:6 mixture at 480 lb. per acre. From the tobacco crop a satisfactory yield of 660 lb. of cured leaf was harvested. (See Plate 122.)

1947-48 *Season.*

Tobacco was again planted after fertilizing with 4:12:6 mixture at the rate of 640 lb. per acre. The growth was very poor and the plants became infested with nematodes. The resultant yield of leaf was only 143 lb. per acre. (See Plate 120.)

Plate 122.

TOBACCO FOLLOWING VELVET BEAN AND SUMMER GRASS FOR ONE YEAR (PLOT 9, 1946-47).

Plot No. 10.

1945-46 *Season.*

Planted to tobacco. One half of the plot was fertilized with 4·5:12·0:4·5 mixture and the other half with 3:9:7 mixture, both at the rate of 960 lb. per acre. The plants mostly made a stunted and irregular growth and became heavily infested with nematode. Odd plants grew well, but the crop as a whole was a failure and was not harvested.

1946-47 *Season.*

The plot was ploughed and sown to Rhodes grass. No fertilizer was applied. The grass grew well during the season and a dense cover was established.

1947-48 *Season.*

The Rhodes grass was ploughed under and the plot prepared for tobacco. The tobacco was planted after fertilizing with 4:12:6 at 480 lb. per acre. A fairly satisfactory yield of 583 lb. per acre of cured leaf was harvested.

FIELD OBSERVATIONS.

An interesting observation of the effect of the various rotations on the soil was made when the whole area had been ploughed and prepared for tobacco at the commencement of the third season. The different plots exhibited various shades of colour from light grey to a much darker grey, the darker shades corresponding with plots on which a heavy cover crop had just been turned under. The darkening in colour was regarded as evidence of a substantial increase in organic matter in the soil.

During a hot dry spell in January-February of the third season the tobacco crops which followed a cover crop in these rotations showed no

badly. Many crops throughout the district also wilted and scorched during this heat wave. It is reasonable to assume from this observation that the organic matter added to the soil had improved its moisture holding capacity, which stood to the plants during the dry period.

Nematode infestation observations made at the end of the third season revealed that few of the plants were attacked on plots where tobacco followed a cover crop. On an average the affected plants represented less than 1 per cent. of the crop, and on these the infestation was so slight that it had no important physiological effect on the plants. On the other hand, a heavy infestation occurred where tobacco had been followed by tobacco and the plants were severely affected thereby.

DISCUSSION.

The trials demonstrated that a dense cover of native grasses and certain sown grasses and legumes can be readily established on these worn-out soils if the soils contain a reasonable amount of plant nutrients and provided stock are not allowed access to the areas. Normally, sufficient plant food to establish a good cover crop would probably be contained in the soil as residual fertilizer following the removal of the tobacco crop. This contention is borne out by the splendid growth of Rhodes grass following tobacco obtained in Plot No. 10.

After turning under a good cover crop the productivity of the soils for tobacco is as good as, or even better than, that of virgin soil, based on yields of cured leaf. Yields above 600 lb. of cured leaf per acre are rarely obtained in the district, whereas in these trials several yields were above that figure.

Although the two-year rotation gave surprisingly satisfactory results it is considered that the longer rotation is preferable and definitely safer.

Legumes appeared to have a pronounced effect on yield. The highest yields followed the ploughing in of a dense stand of Gambia pea, while following a legume-grass mixture the yields were high and better than after grass alone. However, it is thought that this result was largely brought about by the greater rapidity of decomposition of the legume. In the case of the grasses, insufficient time had elapsed between ploughing under and planting to tobacco for complete decomposition of the organic matter to occur, and the strike was adversely affected as a consequence.

The failure of the tobacco crop in the first season paralleled the experience of growers that a bare fallow does not restore the productivity of the soil. Neither is it maintained for more than one season, as illustrated by the failure of the second plantings in Plots Nos. 1, 8 and 9 This also had been the experience of growers.

From the practical aspect an important feature of these trials was the virtual absence of nematode infestation on the tobacco crops following a good cover crop. Nematodes have always been considered a major obstacle to tobacco growing in these soils, but in the light of these investigations it appears that if the soil organic matter content is satisfactory the effects of the pest are negligible.

CONCLUSIONS AND RECOMMENDATIONS.

To maintain the productivity of the Miriam Vale tobacco soils it is evident that some form of rotational cropping must be adopted. As the maintenance of productivity seems to be dependent on the maintenance

of the soil organic matter at a satisfactory level it is desirable, if not essential, that the rotation should include a cover crop. The cover crop should be established as soon as possible after the removal of the tobacco to take advantage of the residual supplies of fertilizer in the soil and to ensure its satisfactory growth while avoiding the necessity of applying more fertilizer. It is important that stock be kept off the area, at least until the cover crop is well established. Judicious grazing so that the cover crop is not destroyed is not likely to have any detrimental effect on the value of the crop for soil renovation purposes and the land need not therefore be entirely unproductive during the renovation period.

The cover crop should be maintained for at least two years and preferably longer. The minimum time required for a satisfactory restoration of soil productivity would depend to some extent on the condition of the cover crop. A dense stand, for example, would effect a considerable improvement after only one year.

The cover crop should be ploughed in about two months before planting to tobacco if weather conditions permit. If it is ploughed in too early, decomposition and loss of humus would proceed fairly rapidly through exposure and leaching and much of the benefit of the crop would be lost by the time the tobacco is planted. On the other hand, sufficient time should elapse for the decomposition of the organic matter to be almost complete when the tobacco is planted, otherwise the establishment and early growth of the tobacco might be adversely affected.

With regard to the choice of crops, it is probable that there are a number of different crops that would form good covers and be efficient renovators on these soils; but it can be confidently stated from the results of these trials that the legume Gambia pea is eminently satisfactory for this purpose. Rhodes grass can also be relied upon to give good results, while in addition it could fill the role of a useful pasture grass. There is no doubt that a Gambia pea–Rhodes grass mixture would also give good results, and the mixed crop would probably decompose in the soil more rapidly than the grass alone. Native grasses and weeds are useful soil renovators if they form a dense cover, but on land which has been recently cultivated they would probably be slow to close in.

While Gambia pea makes a useful cover crop it would be of no value for grazing purposes; in the first place it is regarded as being unpalatable to stock, and in the second it is suspected of having poisonous properties, in common with other plants of this species (rattlepods).

Summing up, from the results of these trials the following procedure can be recommended for restoring the productivity of the Miriam Vale tobacco soils:—

1. Plough or harrow the area in the early summer following the harvest of the tobacco crop.
2. Sow to Gambia pea (10 lb. per acre) or Rhodes grass (10-15 lb. per acre), or a mixture of the two (5 lb. Gambia pea and 7 lb. Rhodes grass).
3. If the area is to be used for grazing, keep stock off until the crop is well established and then avoid overgrazing.
4. Allow the cover crop to remain for at least two years. For this purpose annual crops (e.g. Gambia pea) should be permitted to seed.
5. Turn under about two months before planting to tobacco.

The Mango.

S. E. STEPHENS, Horticulturist, Horticulture Branch.

(*Continued from page 153 of the March Issue.*)

CULTURAL PRACTICES.

Tree Spacing.

AS this fruit tree grows to an immense size on suitable soil and as any interlacing of branches of adjoining trees causes a great reduction in cropping it is essential to allow plenty of room between the trees. A reasonable distance for planting is 40 by 40 feet, but on very good land the spacing could be well increased to 50 by 50 feet. As indicated earlier, a mango tree with a measured branch spread of 125 feet has been recorded, but of course this is abnormally large and such large trees need not be catered for in planning an orchard. However, a 50-feet spread may be considered quite normal in Queensland for mature trees grown under favourable conditions, so such a tree size should be kept in mind when considering the layout. At 40 by 40 feet spacing, 27 trees per acre may be planted and at 50 by 50 feet, 18 can be accommodated.

On poor soils, and under adverse climatic conditions such as cold winter temperatures, tree growth will be much less vigorous, so planting distances of 35 by 35 feet, allowing 35 trees per acre, may be quite safely employed.

Setting out the Trees.

If young seedlings, raised as already explained, are to be used the planting of the orchard entails little difficulty. The plants should have the foliage reduced by about two-thirds, which is accomplished by cutting off two-thirds of each leaf, and the young tree is then set in a hole prepared in the usual manner for tree planting. A hole of ample size to accommodate the roots without bending them must be dug. The young tree must be set the same depth in the soil as it was in the seed-bed, and the soil should be firmly trodden in round the roots when refilling the hole. A bucket of water is poured into the hole before it is completely filled and, when this has soaked away, the hole

is topped off with dry soil. Shade from a small leafy branch pushed into the soil beside it gives the young plant a chance to establish itself if weather conditions should be adverse.

If budded trees or large seedling plants are to be used in establishing the orchard the preparation for planting is rather more involved, as preliminary conditioning of the young trees is necessary. This should be carried out about six weeks before it is desired to plant the orchard and consists of digging down beside each tree to a depth of about 12 inches and severing the tap root. Sometimes mangoes have a forked tap root. In such cases, both branches of the root must be cut. The cutting is best accomplished with secateurs, so that a clean cut without bruising of the bark is obtained. The hole is then refilled and the trees given a good watering.

The object of this root-cutting operation is to induce the formation of many vigorous surface roots. The root cutting must not be done too long before transplanting as the tree commences to grow a new tap root from the severed end within a short time after the operation and the development of this defeats the objective.

When the root forming period has elapsed, the young tree should be carefully dug to retain a ball of earth on the roots and then set in the prepared hole in the orchard, with the usual planting practices of firming the soil and watering in. Shortening back of the foliage to about half is sufficient to allow the establishment of a well-balled tree.

If bare root planting is necessary, as may be the case when the young trees have to be transported some distance, then the roots should be well puddled immediately the plants are dug and a good three-quarters of the foliage cut away. The digging of the trees should, of course, have been preceded by the customary severing of the tap root. Such trees are then planted in the same way as any other tree received from a nursery. They will require care in the provision of shade and water until they become established. Even so, the mortality in bare root planted trees is much higher than that in balled trees.

The best time for transplanting mangoes is in the summer during the monsoonal wet season. At this period there is not only ample soil moisture to ensure growth but the atmospheric moisture is also high, so the tops are not subjected to desiccating air influences during the difficult period of establishment.

Balled or potted trees are less affected by adverse weather than are bare root plants since their rooting system is not subjected to such disruption. Such plants may therefore be set out quite successfully at other times of the year, provided facilities are available for watering regularly. In all cases the plants should be moved only when they are in a dormant condition, which is indicated by the normal dark-green colour of the terminal shoots.

Cultivation.

The usual methods of orchard cultivation are recommended. During the early years of the establishment of a mango orchard, use can be made of the wide inter-row spaces to grow small crops. The cultivation required by these will maintain the land in good condition for the mangoes, and the crops produced will assist to cover the costs of establishing and tending the orchard.

After the trees have reached an age and size that render further intercropping inadvisable, and also during the earlier years at times when cropping is not being practised, it is desirable to have the soil protected by a cover crop. Such cover crops as cowpeas—Black, Poona, Groit, Clay, Giant, or other variety—are suitable for short term covers, and the perennials such as dolichos,* calopo,† and Madagascar bean‡ for long term covers. Centro§ is not as suitable on account of its pronounced tendency to climb trees. Even those listed as suitable must be watched and cut back from young trees from time to time to prevent smothering.

Pruning.

The whipstick seedling should have its terminal bud pinched out when it reaches a height of about 3 feet in order to start the main frame of the tree. Failure to do this often results in a single straight sapling 15 to 18 feet high. If pinching back has been neglected at the correct period, then it will be necessary to cut back the top to a point just above a growth ring at the appropriate height. A number of shoots will grow from the head at the next flush. They should be reduced to two or three to form the main branches. These in turn can be pinched back when they have made 18 inches to 2 feet of growth to induce further branching. The only pruning needed subsequently is the removal of weak shoots that grow in the centre of the tree, the cutting out of branches that cause overcrowding and the shortening back of limbs that droop too close to the ground.

The season for pruning is immediately following fruit harvesting when the trees are dormant for a short period.

Fertilizing.

The manurial requirements of the mango are not fully known. No experimental work has yet been undertaken in Queensland on the subject and the present recommendations from overseas countries do not appear to have been based on any extensive experimentation. However, research on the subject now in progress in several countries should lead to the laying down of a manurial programme based on accurate knowledge of the requirements of the tree.

The opinions of overseas authorities seem to agree that the trees require fairly large applications of nitrogenous manure during the early years of growth and that once fruiting commences the emphasis should be on phosphate and potash. The balance of opinion regarding the nitrogen applications is that farmyard manure, dried blood, or some other form of organic nitrogen is preferable, but that its application after fruiting commences is inadvisable. Much stress is placed on the importance of phosphate and potash in ensuring regular cropping. Recommendations for bearing trees favour complete fertilizer mixtures of formulae such as 4:8:8, 5:8:10, 5:8:15, and 5:15:12. It will be seen there is fairly general agreement regarding the percentage of nitrogen, but the proportions of phosphate and potash recommended vary. However, for the purpose of fertilizing mango trees in Queensland these formulae may be adopted as a general basis. The one to be selected should be that containing the higher proportion of the element known to be most deficient in the particular orchard or district.

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* *Dolichos hosei.*

† *Calopogonium mucunoides.*

‡ *Phaseolus lunatus.*

§ *Centrosema pubescens.*

Regarding the amount of fertilizer per tree, opinions are just as varied as they are concerning the best source of manurial constituents and their proportions. On the basis of the percentages of N, P and K contained in the standard fertilizers available in Queensland, the overseas recommendations vary from 1 lb. to 7 lb. of complete mixture for young trees and 8 lb. to 40 lb. for mature bearing trees. It may therefore be concluded that at present the amount of fertilizer to apply must be governed very largely by the general fertility level of the soil. Thus, trees planted on soils known to be fairly well provided with available plant foods could receive amounts in the lower range of applications, while those on the poorer soils should be given the larger amounts. The condition of the individual trees should, however, also be taken into consideration when deciding on the amount of fertilizer needed.

As to time of application of fertilizer, there is fairly general agreement that applications immediately before and immediately after the summer wet season give best results, the total annual dressing being split fairly evenly between the two periods.

FRUITING.

In coastal North Queensland, the flowering season is very long. In some years the first blossoms may appear late in April and at times the flowering has continued as late as mid-October. Flowers may be noted on the trees throughout the whole of this period, but two seasons of heavy flowering occur. These vary by a few weeks in different parts but occur approximately during part of the June-July and part of the August-September periods.

In sub-tropical Queensland and on the northern highlands, the flowering period is restricted to the spring months of August to October.

With such extended flowering as occurs in North Queensland, the fruiting period may be expected to be similarly extended. However, except in the case of the Townsville district, this is rarely the case, for, as has been noted above in connection with climate, early flowers are destroyed by fungal infection. Except for Townsville, where fruit from the early flowering is harvested during August and September, the main fruit ripening season extends from November to the end of January. With increase of south latitude and also with increased altitude in the tropical area, the maturity season becomes later, extending to late March at the extreme Queensland range. The age of a mango tree at first fruiting is variable but the general rule is five to seven years. Some varieties commence at an earlier age. The variety Kensington is extremely precocious when grown under good conditions, as its first fruits are borne at three years of age.

Four to five months usually elapse between flowering and maturity of fruit. During the early stages of growth the fruit is normally of a dark green colour, but as it approaches full size the skin commences to assume a blush characteristic of the particular variety on the cheek exposed to the light. However, colouration is environmental as well as varietal and may vary in the one variety grown under different environmental conditions. This is particularly apparent in the case of soil factors influencing density of tree growth. Under conditions that produce a dense head the dominant colour in the fruit is yellow, the red blush being lacking.

During the short period of about 10 days before full maturity is reached, the fruit fills out, increasing considerably in minor diameter and appreciably in major diameter. When this occurs the fruit is mature and will ripen satisfactorily if picked. It will be found, too, that at this stage the fruit stem snaps readily when the fruit is bent back sharply on it. At earlier stages of development the stem attachment is very secure. A strong pull is necessary to dislodge the fruit and often the full length of stem comes away attached to the fruit. Abscission cells in the stem, which permit the easy breaking, apparently develop only when the mango is very near to maturity.

Plate 123.
MANGO FLOWERS ILLUSTRATING THE TIP FLOWERING HABIT AND PANICULATE INFLORESCENCE.

HARVESTING.

Fruit harvesting from a large tree such as the mango is not an easy operation. It is, of course, essential that the fruit be picked carefully from the tree by hand and placed carefully into the picking boxes. Gathering the fruit from the ground after it has been dislodged by rough shaking of the tree should not be tolerated. Fruit on the lower branches can be harvested easily from a cart or truck but the higher fruit, which is often the best fruit on the tree, is difficult to secure. A proportion of such fruit can be picked from the inside by

climbing into the branches, but most of it is on the outermost tips of the branches and so beyond reach from inside. Three methods can be used successfully to harvest this fruit.

The first involves a long, light rod fitted with a hook and a bag at one end. The bag is arranged under the hook with its mouth held open so that the fruit, when hooked and pulled, falls into it. The bag should

Plate 124.

VIEW OF MANGO-HARVESTING LADDER ILLUSTRATING DETAILS OF CONSTRUCTION.

be only shallow and of small capacity as it is not possible to support the weight of more than four or five fruit on the end of the long rod and still operate it with ease. Though fairly satisfactory, this method is slow.

For the second method a long light ladder to lean against the tree is required. As a ladder of the length required to reach the highest parts of a tree would be cumbersome to handle and also rather insecure if stood on its own narrow base, a good plan is to fit it on a pair of wheels with a wide axle, such as a pair of old hay rake or sulky wheels. Plate 124 illustrates such an arrangement as used by a mango grower on Magnetic Island. The ladder is easily wheeled from place to place as required and when the top is leaned against a tree and the feet dropped on the ground it is quite rigid.

An elevated platform, which is the third method, is probably the most effective arrangement but is more elaborate and more expensive to construct. It is actually a small tower of light construction equipped with an extending platform on top and hinged platforms at intervals as required up its side. The tower is mounted on the back of a truck, the picker or pickers working from the platforms and moving the truck round the trees as required. The arrangement is on exactly the same principle as the tower used by electric authorities for attending overhead tramway wires or lights, with the addition of one or more drop platforms at different heights.

Handling of fruit at all stages, whether in the orchard or in the packing shed, must be carried out with care. Mango fruit bruises very readily and then breaks down rapidly.

Information on the grading and packing of fruit does not come within the scope of this article but may be obtained from the Department of Agriculture and Stock, Brisbane.

YIELD.

Fruit yield is very variable from variety to variety quite apart from the annual variation due to seasons and climate. The Queensland Common variety is consistently a heavy cropper and in the Bowen district is estimated to give an average harvested yield of eight bushels per tree. This, however, is only a portion of the yield as the Commons are seldom fully harvested. The Kensington variety crop, which is harvested in its entirety, averages four bushels from trees in early maturity, that is, at 10 to 15 years of age.

Aged trees over 25 or 30 years produce yields up to double those quoted above but accurate figures for these are not available.

PESTS AND DISEASES.

In common with most other cultivated fruits, the mango is frequently subjected to attack by fruit fly, and in addition there are at least two pests peculiar to this particular fruit.

The mango weevil* causes some loss of crop by burrowing into the seed. Only one larva of the weevil usually enters a fruit. Its entry is made while the fruit is very young and the injury is so slight that it often heals over completely during the growth of the fruit. Sometimes it causes fruit deformity but often there is no external evidence of its presence. Its feeding in the seed often causes premature ripening and shedding of the fruit. In some seasons the pest is responsible for the fall of much of the crop on individual trees.

The tip borer† is the larva of a moth which lays its eggs on or near the tip growth of mango shoots. The larvae enter the immature shoots and tunnel them out back to the hard wood. This results in the death of the tip growth and the development at the subsequent growth flush of a number of shoots from the injured terminal. If these in turn are attacked, as frequently happens, and further fresh growths from the same point similarly destroyed, a deformed condition develops. In

* *Cryptorhynchus mangiferae.*

† *Peperita euthysticta.*

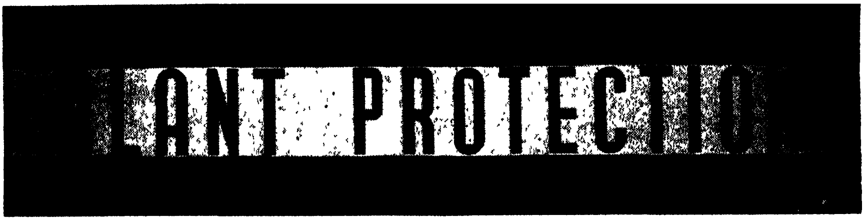
addition to causing more or less permanent disfigurement to the tree, the destruction of the young shoots affects cropping. Plate 125 illustrates the type of injury caused by the tip borer.

Parrots during daylight hours and fruit bats or flying foxes at night cause much destruction at times. In taking steps to combat them it is essential to destroy the first marauders as soon as they discover the fruit because on each occasion on which they return to the tree they bring more of their companions with them.

Plate 125.
TYPICAL INJURY CAUSED BY THE MANGO TIP BORER.

Mention has been made previously of the injury and loss caused by a fungus. This is commonly known as anthracnose. It is responsible for the destruction of flowers and young fruit and for the tear streaking of fruit in the more advanced stages of development.

Detailed information regarding the pests and diseases of the mango and methods for their control may be obtained from the Department of Agriculture and Stock, Brisbane.



The Control of Heliothis in Linseed.

A. W. S. MAY, Entomologist, Science Branch.

DURING the past two years, considerable progress has been made in establishing linseed as a commercial crop on the Darling Downs and adjacent inland districts. Although the acreage sown to this crop should expand considerably in future years, certain problems must be solved before linseed growing can become firmly established. The part played by pests threatens to become a major issue in the successful cultivation of this crop and growers are well advised to make themselves familiar with this problem so that crop losses can be avoided.

The corn ear worm, or Heliothis*, has long been recognised as an important pest of maize, cotton, lucerne, tomatoes and other crops in this State, while it had also been recorded elsewhere as a pest of linseed. Although it caused little damage to small experimental sowings of linseed in Queensland in 1947, it attained major importance during the following year and may have greatly reduced yields had not the likelihood of pest attack been anticipated and the necessary measures taken to counteract it.

DESCRIPTION OF HELIOTHIS.

The moth has a wing expanse of about one-and-a-half inches and varies in colour, the average having grey-brown forewings marked with dark-grey irregular lines and smoky-grey hind wings which darken towards the edges. They are stout bodied and fly very rapidly, particularly when disturbed in a crop. On cloudy days in early spring they may be seen flying among the linseed, but more usually they fly at dusk and on warm evenings deposit their small whitish eggs singly on the buds, flowers and tips of plants. On the average, a moth can lay over 1,000 eggs during the two weeks of its life.

The young larvae hatch within a week of egg-laying and at first feed on the flower parts or unopened buds close to where the eggs were deposited. As they develop they favour the seed capsules, eating out the developing seed. When fully grown, the larvae measure approximately 1½ inches long and vary considerably in colour, individuals in a crop ranging through shades of green and brown to black, each being additionally marked with longitudinal stripes.

The larval stage lasts from two or four weeks, during which time one larva may destroy a large proportion of the seed capsules on a plant, showing little tendency to migrate far from the site where the

* *Heliothis armigera* Hbn.

egg was deposited. When fully grown, the larva descends the plant and enters the soil, where it changes into the resting stage known as the pupa, from which a moth subsequently emerges.

FACTORS INFLUENCING PEST ATTACK.

Linseed crops planted in late autumn rarely suffer damage from the pest until the seed capsules are forming in the following spring. By this time some Heliothis moths will have emerged from the over-wintering pupae in the soil and having matured their eggs will be eagerly seeking a suitable host on which to deposit them. Flowering linseed is very attractive to these moths. It is therefore evident that the amount of damage done to a linseed crop will depend on three factors:—(1) the number of moths present in the spring; (2) the time that they are ready for egg-laying; and (3) the time that the linseed flowers and becomes attractive.

The number of moths emerging in the spring is governed by the pest population in the preceding autumn and the survival rate of the overwintering pupae. Apart from attacking many cultivated crops, this pest can breed on numerous weeds, and these latter hosts are often responsible for some of the more serious outbreaks that occur from time to time. Good growing conditions in the preceding summer and autumn will ensure many hosts for a large-scale breeding of this pest and may give rise to a large pest population by late autumn. In addition, high soil moisture during winter favours survival of the hibernating pupae in the soil and also ensures early moth emergence.

The time of moth emergence in the spring is a reflection of soil temperature and soil moisture during winter. Some moths may be present in early September, but a certain time must elapse between moth emergence from the soil and egg-laying; thus crops flowering early in September may escape attack, while crops flowering later in the month would experience greater damage. Thus from early September onwards, with the number of moths increasing as emergence proceeds, the time of flowering of the linseed will govern the extent of pest attack.

Investigations in the 1948 season supported these conclusions. Ideal conditions for breeding in the preceding summer and autumn were followed by a winter favourable for pupal survival. Crop damage increased very appreciably as the date of flowering of individual crops was delayed through September and into October. These conditions will not be repeated every year but will fluctuate considerably insofar as the many factors governing the pest build-up and crop development vary. It is sufficient to state that the likelihood of pest attack can only be gauged with certainty by an actual observation of the moth population in the crop at flowering time. The weather conditions of summer, autumn and winter may suggest conditions for or against a pest outbreak, but farmers are advised to be prepared for any eventuality in the spring.

CONTROL MEASURES.

The Value of Certain Cultural Measures.

Though control of this pest may be achieved by the application of DDT, the likelihood of pest damage in the spring can be offset to a considerable degree by the proper use of cultural measures. There

are many factors governing the probability of Heliothis attack in the spring, and it is extremely difficult to forecast what may eventuate. In years when winter rains are light, the pest position may not be serious and satisfactory control may be possible by these measures alone.

Experience has shown that even in years when moths are prevalent in the spring early-planted crops largely escape Heliothis damage. In such instances, early crops have completed flowering before many moths have emerged and cease to be attractive for egg-laying. Planting in early May gave the best results in the 1948 season, although it is possible that April sowings may have an added advantage. Admittedly, weather conditions, adequate soil moisture and seed-bed preparation all govern the time of seed sowing, but where possible farmers should aim to plant their crops as early as practicable and so promote flowering in the early spring. When a dry autumn delays operations. planting should proceed at the first opportunity.

The rate of seed sowing is another important consideration, for it may govern the rate of crop development and the period of flower formation. Any tendency to prolong flower production will serve to increase the period that the crop is attractive for egg-laying. Although often conducive to heavy yields under certain growing conditions, the late flowers tend to prolong moth activity, and in the case of early-planted crops attract moths after the greater part of the crop has formed. These late-formed buds and seed capsules will be destroyed should egg-laying occur, the larvae in time attacking the earlier formed capsules, which would have escaped damage had these late flowers not developed to any great extent.

It is difficult to prevent some late flowers developing in a crop, but where possible measures should be adopted to offset this tendency. A relatively dense stand of plants, apart from suppressing unwanted weed growth and ensuring an even rate of seed development, will reduce the likelihood of prolonged flowering. Thin stands, on the other hand, in addition to reducing the possible yield per acre, may allow secondary branching and late flowerings should spring rains eventuate and will most certainly take longer to mature.

A seeding rate of from 23 to 25 lb. per acre seems best under the circumstances. It produces a relatively dense stand of plants that flowers evenly and matures its crop more quickly than thinner stands.

Chemical Control.

Although the use of sound cultural measures, particularly those mentioned above, can offset the possibility of serious pest damage and may even obviate the necessity for insecticidal treatment, the farmer should always watch for moth activity in linseed at flowering time. Where a heavy yield is assured, every precaution should be taken to safeguard against crop loss, particularly where planting has been delayed. Any signs of moth activity at flowering time should be viewed with apprehension and treatment applied promptly. Egg-laying will continue as long as moths are present in a crop and flowers are being formed. Crops that have not reached the flowering stage may become infested should moth activity be exceptionally heavy.

Power Dusting.

Where suitable power-operated equipment is available, the application of DDT dust has proved a quick method of treating large areas of crop. A 5 per cent. DDT dust applied at the rate of 15 lb. per acre will give efficient control of Heliothis larvae. Treatment should be commenced immediately after the bulk of the flowering has ceased and before the newly hatched larvae have had time to damage the crop. Efficient dust application requires a still atmosphere, and so early morning or late afternoon dusting is preferable.

An efficient power-operated machine should be capable of covering approximately 8 acres of crop per hour. Dust application by aeroplane, where possible, has proved an ideal method of treating large areas.

Power Spraying.

The application of DDT in spray form has also proved very satisfactory for Heliothis control in linseed, the DDT being applied at 0·2 per cent. concentration at a dosage rate of up to 100 gallons per acre. DDT in either the dispersible powder or the emulsion form may be used for spray preparation. Power spraying machines especially adapted for mounting on to motor trucks or tractors have been developed for spraying field crops and these are ideally suited for spraying linseed for pest control. A boom of 30 to 40 feet evenly distributes the spray material as a vehicle is driven slowly through the crop.

Although a dosage rate of 100 gallons per acre is recommended, certain types of machines are incapable of putting out this quantity of material per acre, the amount actually delivered being nearer half the recommended rate of application. A dosage as low as 40 gallons per acre, using 0.2 per cent. DDT, has been used successfully. A greatly reduced rate of application, using higher concentrations of DDT, is an important consideration in treating large areas of crop as it overcomes the necessity for carting water to recharge the spray tank at frequent intervals. The need for carting large quantities of water, apart from delaying operations, tends to increase the likelihood of damage to the crop by vehicles. Spray machines combining a low dosage rate with increased insecticidal concentration are being developed, and should revolutionise pest control where crops are grown in large acreages.

In contrast to dust application, spraying can be carried out under much less exacting weather conditions and may proceed despite slight winds. Although power syraying equipment varies a great deal in design and output per hour, a machine carrying a 30-feet boom and driven at approximately 4 miles per hour should cover roughly 15 acres per hour. However, the need for refilling the spray tank may cut the acreage per hour by as much as one-half.

Damage to Crops by Vehicles.

When properly operated, little material damage to the crop is caused by the trucks or other vehicles used to carry the power operated spraying or dusting equipment. Furthermore, if treatment is applied soon after flowering the plants should show little evidence of vehicular traffic by harvest time. Generally, the wheels can be made to track

in the spaces between adjacent drills, while the crop between the wheels rises again soon after the vehicle has passed. Most damage occurs where the vehicle turns, but again a good proportion of the plants will rise again before harvesting. At a conservative estimate, less than 2 per cent. of the crop would be destroyed by a truck fitted for spraying and carrying a 30-feet boom, though more damage may be associated with the use of a power duster treating only half this width at each run through the crop.

CONCLUSIONS.

The adoption of cultural measures to ensure flowering in the early spring will go a long way towards reducing the likelihood of pest attack and will eliminate this possibility altogether in some years. In view of two important considerations—namely, cost of treatment and shortage of suitable machines for applying the insecticide—this method of control has much to commend it and will play an important part in establishing the crop on a sound cultural basis. As a safeguard, a farmer who hopes to rely on cultural measures should keep a close watch on moth activity at flowering time so that chemical control measures can be taken if and when required.

While not a difficult problem in itself, the successful control of Heliothis in linseed by spraying or dusting may be dependent on the availability of equipment and, with the possibility of a further increase in acreage in future years, the need for large numbers of spraying and dusting machines becomes obvious. The routine application of DDT soon after flowering has much to commend it where equipment and materials are available.

QUEENSLAND SHOW DATES.

Barcaldine	May 13-14	Laidley	July 8-9
Beaudesert	May 6-7	Lawnton	July 29-30
Beenleigh	September 16-17	Longreach	May 3-5
Blackbutt	June 3-4	Lowood	June 10-13
Boonah	June 3-4	Mackay	June 28-30
Bowen	July 6-7	Maleny	May 12-13
Brisbane R.N.A.	August 6-13	Marburg	May 13-14
Bundaberg	June 9-11	Maryborough	June 2-4
Cairns	July 19-21	Mitchell	May 11-12
Charleville	May 18-19	Mount Morgan Show	June 2-3
Childers	June 6-7	Mt. Morgan Camp Draft	June 4
Crow's Nest	May 27-28	Mundubbera	May 6-7
Dirranbandi	May 27-28	Murgon	May 19-21
Esk	July 1-2	Nambour	July 7-9
Gatton	July 21-23	Proserpine	July 1-2
Gin Gin	June 13-14	Redlands	July 15-16
Goombungee	May 21	Rockhampton	June 22-25
Goomeri	May 24-25	Roma	May 4-5
Gympie	May 26-28	Rosewood	July 15-16
Home Hill	July 1-2	Toogoolawah	June 17-18
Ingham	July 15-16	Townsville	July 12-14
Ipswich	May 17-19	Warrill View	May 21
Kalbar	May 28	Wondai	May 12-14
Kilcoy	June 24-25	Woodford	July 15-16
Kilkivan	June 10-11		
Kingaroy	May 5-7		

Cheese Starter: Its Preparation and Control.

E. B. RICE, Director of Dairying, and L. E. NICHOLS, Assistant Director of Dairying.

A CHEESE starter is a culture of living microorganisms used for the purpose of bringing about certain changes during the manufacture and/or ripening of cheese. Different species of organisms are used in the manufacture of the many varieties of cheese; for example, lactic acid bacteria for producing acid in cheddar cheese-making, propionic acid bacteria for ensuring eye formation in Gruyere cheese, and moulds for the blue-veined cheeses.

This paper deals only with starters for cheddar cheesemaking.

Starters are prepared by various Government and proprietary laboratories and supplied to cheese factories in powder or liquid form. Separated or whole milk is the usual medium for the propagation of the starter in a factory.

Some commercial laboratories include certain aroma-producing bacteria in starters for cheddar cheese. However, they are not essential in these cultures. The particular species of bacterium contained in the starters which are now supplied by the Queensland Dairy Research Laboratory is known as *Streptococcus cremoris*, strains of which are used in starters produced by all the leading dairying institutes. The organisms are cultured daily in the laboratory in sterilized separated milk and transferred to a bottle of sterilized chalk litmus milk prior to despatch to a factory. This procedure ensures that the starter will be in a vigorous condition and ready for inoculating the mother starter immediately upon arrival at the factory. Some powder cultures need subculturing for several days before being used as mother starter, as the organisms take a few days to regain full vigour.

Advantages of Single-strain Cultures.

There are two types of commercial starter culture: (1) *Single-strain*, containing one strain only of starter bacteria; (2) *Mixed cultures*, containing more than one strain of starter bacteria.

Single-strain cultures usually have better vitality, produce acid more uniformly and give a closer-textured cheese, but are susceptible to the effects of bacteriophage, which may slow down or completely stop acid production in the starter or cheesemaking vat. Mixed strain cultures are less susceptible to the effects of bacteriophage, but they are also less vigorous, and tend to produce a more open-textured cheese.

Functions of the Starter.

In the manufacture of cheddar cheese the starter produces acid in the milk prior to and after adding the rennet. In making cheddar cheese from pasteurised milk, it is necessary to add starter to inoculate the pasteurised milk with the desired acid-forming bacteria. Even if milk of comparatively high acidity is received and manufactured without pasteurisation, a small quantity of good starter tends to suppress the undesirable bacteria in the raw milk.

The acidity developed by the starter has several effects:—

1. It ripens the milk and produces acid during manufacture. Ripening the milk favours the coagulation with rennet. Milk of too low acidity curdles slowly with rennet and the manufacturing period would be prolonged.

2. It causes the expulsion of the whey. The bacteria which are trapped in the curd produce acid, the curd shrinks and the whey is expelled.

3. It assists the fusing of the curd particles (matting). This gives a mellow body and texture to the cheese.

4. It has a protective action against putrefaction. The putrefactive bacteria, being susceptible to acidity, are restrained in the acid medium, but would quickly spoil the cheese if insufficient acid was present.

5. It stimulates the action of the enzymes in the rennet. Rennet not only coagulates milk due to the enzyme rennin, but other enzymes which it contains have a digestive effect in the presence of acid. They act on the curd in the vat and throughout the ripening of the cheese.

Notes on Plate 126.—

Windows to be 4 ft. × 2 ft., fixed sashes.

Doors to be 2 ft. 6 in. wide.

Sills to doors, studs and heads to be rebated and packed with sponge rubber, saddler's felt, or other suitable material.

Concrete topping to floors of three rooms to be 1½ in. thick, reinforced with chicken wire netting; each floor to have a fall towards an outlet discharging through the floor, complete with trap, &c.

Cover strips to ceiling to be 2 in. × ⅝ in. pine and those to walls 1 in. × ⅜ in. pine.

Hood connected to ceiling to be provided over "steamer."

Ventilating fan to be multivane centrifugal (size 0, Richardson or other approved type). Fan to be connected to oil filter with canvas connectors.

Movable box protecting fan and motor, &c., to have air inlet opening.

Drainage to be provided to suit site.

Building to be painted internally with mould-resistant paint.

Building to be at least 50 ft. from factory, and site to be selected according to position of whey tanks and prevailing winds.

Vitality of Starters.

A starter must be capable of producing acidity at the desired rate throughout the making operations. A starter may develop acid when it is first introduced into the vat of milk, but fail to maintain its vitality in the "cooking" and cheddaring stages. During the "cooking" the milk is raised to between 100 and 102 deg. F., and in extreme cases to 104 deg. F., temperatures which are higher than the optimum for the starter bacteria; while the comparatively dry curd at cheddaring is not conducive to their best development. There is thus a possibility of a starter failing to give a steady increase in acidity during these stages unless its vitality is good.

Contamination of Starters.

The necessity for the utmost care and cleanliness in all operations connected with starter making cannot be over-emphasised. A

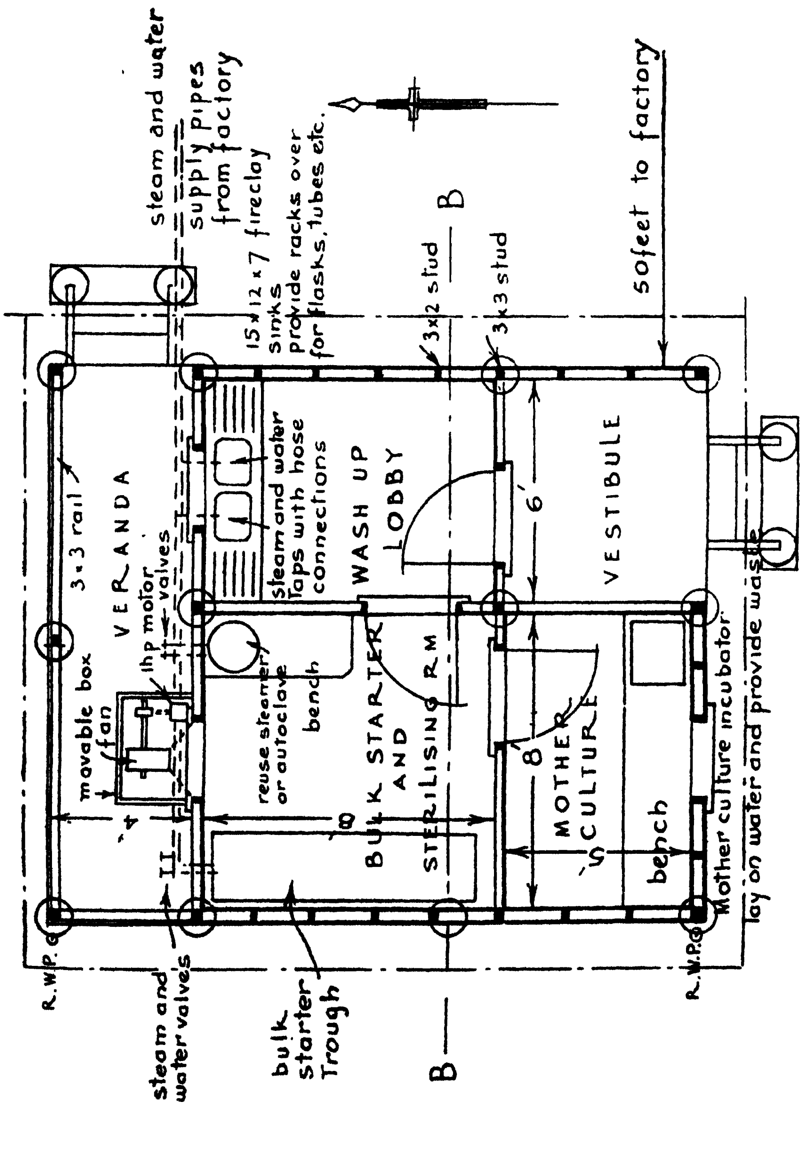


Plate 126.

FLOOR PLAN OF AN ISOLATED STARTER ROOM.
(For further details see notes at foot of opposite page.)

contaminated starter may show no abnormality in flavour or aroma and be quite active in the vat, but it will adversely affect the quality of cheese.

The examination of mother starters at factories frequently shows them to be contaminated with the gas-forming coliform bacteria, and yeasts and moulds, which grow in an acid medium; the contamination thus becomes progressively greater.

The cheesemaking room is unsuitable for propagating starter on account of the high temperatures, the risk of contamination from splashes of water and other sources, and infection with bacteriophage.

The most serious type of starter contamination is bacteriophage, and the methods of starter propagation now recommended are based on measures for its control.

To minimise the contamination of starters all cheese factories should provide a suitably constructed starter room, isolated from the cheesemaking room and fitted with the facilities shown in Plate 126. However, if the starter room is attached to the making room it is essential that direct access be guarded against by having doors arranged to the outside of the factory.

Another cause of slow starter is due to what is known as "non-acid" milk—a colloquial term coined by cheese-makers to designate milk which hinders the development of acid by a normally active starter culture in the cheese vat. Certain organisms, some closely related to the typical starter bacteria, produce an inhibiting substance, delaying the growth of the starter. There is a suspicion that the careless use of chlorine compounds on the farm may leave sufficient residual chlorine in the milk to affect the starter. Milk drawn from cows immediately following penicillin treatment for mastitis has also been found to contain sufficient penicillin to be detrimental to starter development. "Non-acid" milk can be readily detected and any factory suspecting trouble from it is advised to contact the local Dairy Officer, who will carry out the necessary test and advise the producer or producers concerned on remedial measures.

Milk for Starter Cultures.

Good quality, mixed morning's milk should be used for the propagation of starter. The milk may be separated before use, as the butter-fat is not needed for starter growth.

Quantity of Starter to Add to the Vat.

The quantity of starter to be added to the milk for cheesemaking depends on the initial acidity of the milk and whether it is pasteurised or unpasteurised. Care should be taken not to add too much starter. The amount usually varies from one to two per cent., depending mainly on seasonal conditions, the higher percentage being used in the winter months.

Notes on Plate 127.—

The mother culture steamer should be at least 15 in. × 15 in. × 15 in. in size, and made preferably of stainless steel.

The pyrex Erlenmeyer flasks enable any undesirable fermentation in the cultures to be observed. The cotton-wool plugs minimise contamination of starters and facilitate propagation and control.

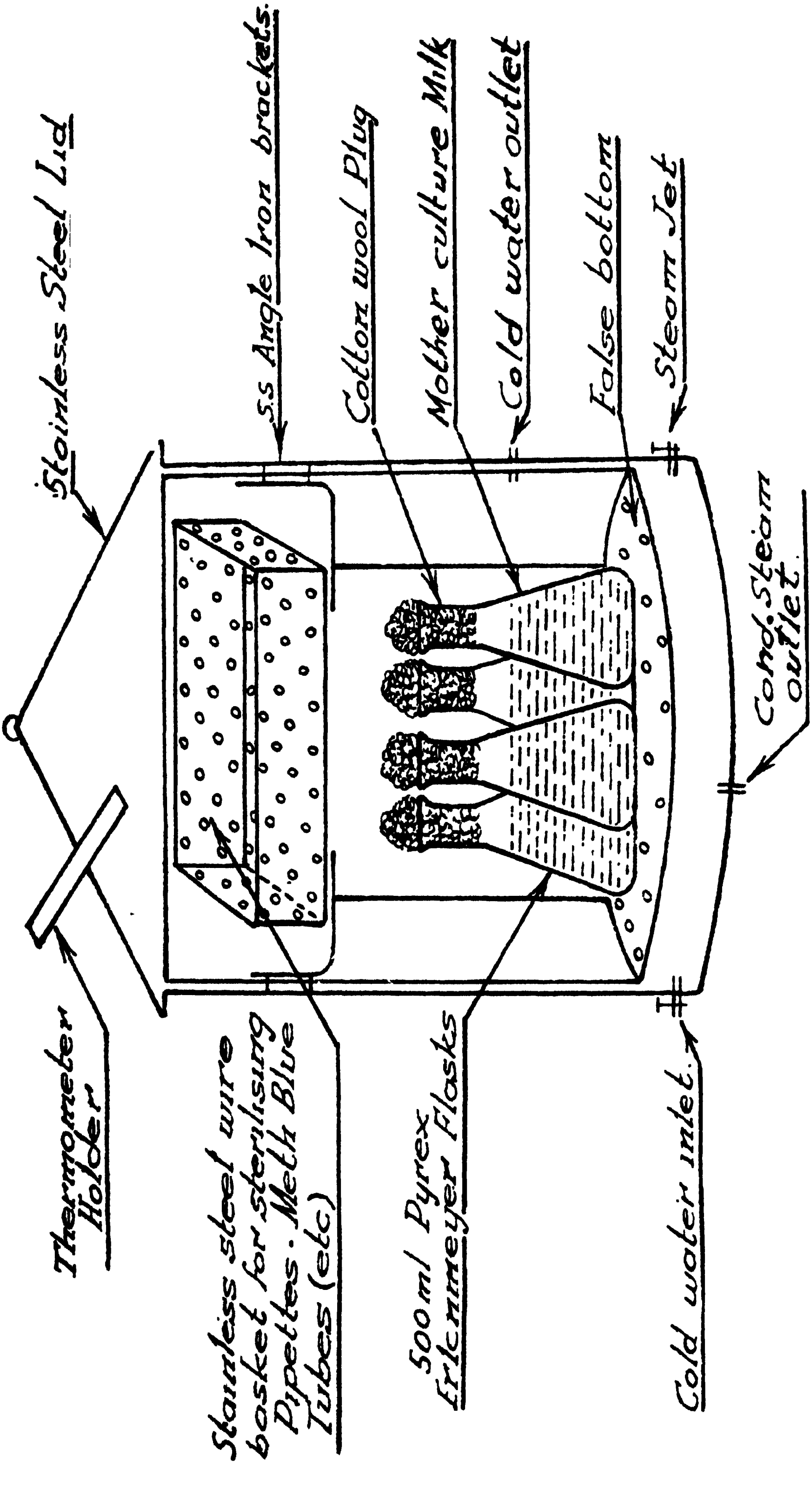


Plate 127.

DIAGRAM OF MOTHER CULTURE STEAMER.
(For further details see notes at foot of opposite page.)

Propagation of Mother Culture.

In Queensland, starter cultures are supplied to factories in chalk litmus milk in which the bacteria can remain viable for some days. However, the culture should be subcultured as soon as possible after arrival at the factory. The success of starter control depends on the personal element, the technique of propagation, and the equipment available. Prior to commencing propagation (usually when the day's manufacturing operations are completed) the operator should discard the overalls used in manufacture, have a shower and change into clean overalls, then wash his hands and arms in a solution of hypochlorite.

All factories should have a mother culture sterilizer (Plate 127) suitable for the sterilizing and cooling of milk samples, pipettes, &c., used for starter propagation.

To prepare a mother starter, place about 400 ml. (approximately ¾ pint) of selected milk in a thoroughly clean Erlenmeyer flask, the neck of which is carefully plugged with cotton wool, and sterilize by steaming in a mother culture sterilizer for two hours. Cool to 70-75 deg. F. Mix the laboratory culture by tipping gently until homogeneous. Flame the neck of the culture bottle with a methylated spirit burner and remove the waxed screwcap lid. Flame a sterile inoculation pipette, withdraw 10 ml. of the culture and add to the sterile milk in the Erlenmeyer flask. (In pipetting this quantity only approximate and not accurate measurement is needed.) Quickly insert the cotton wool plug after flaming. Where electric power is available mother cultures should be kept in a thermostatically-controlled incubator or an improvised apparatus which permits control of temperature at about 70 deg. F. The culture should be incubated at 70-75 deg. F. until the milk has coagulated, when the mother culture for the succeeding day may be prepared from the coagulated cultures. Sufficient mother starter is prepared daily to inoculate the bulk starter at the rate of 1–2 per cent., depending on the time of inoculation and temperature control. At least four 500 ml. pyrex Erlenmeyer flasks are necessary to enable a rotation of starters.

The steps in propagating starter each day are:—

1. Inoculate from clotted mother culture into the steamed milk in an Erlenmeyer flask to prepare mother starter for the next day.
2. Inoculate mother starter into pasteurised bulk-starter milk for next day's bulk culture.

Propagation of Bulk Culture.

For the large quantity of milk needed for bulk starter, heating and cooling of the starter cans (usually 10-gallon stainless steel cans) should be done in either a trough (Plate 128) or cabinet (Plate 127) through which water can be circulated. A bulk starter cabinet affords further protection of the bulk starter, avoids the condensation of steam in the starter-room and assists in controlling the temperature. A steam exhaust outlet, fitted with shut-off cock, permits heated air and steam to pass out. By shutting the steam exhaust outlet when cooling commences, ingress of possibly contaminated air to the cabinet is avoided. About 8 gallons of morning's milk is poured into each can. (The number of cans will depend on the gallonage of milk received for cheese manufacture.) The water surrounding the cans in the tub is heated by

turning on the steam. The temperature of the milk is raised to approximately 200 deg. F., maintained for one hour, the steam-valve closed and cold water passed through the cabinet, entering at the bottom, until the milk is cooled to 70-75 deg. F. The milk is then

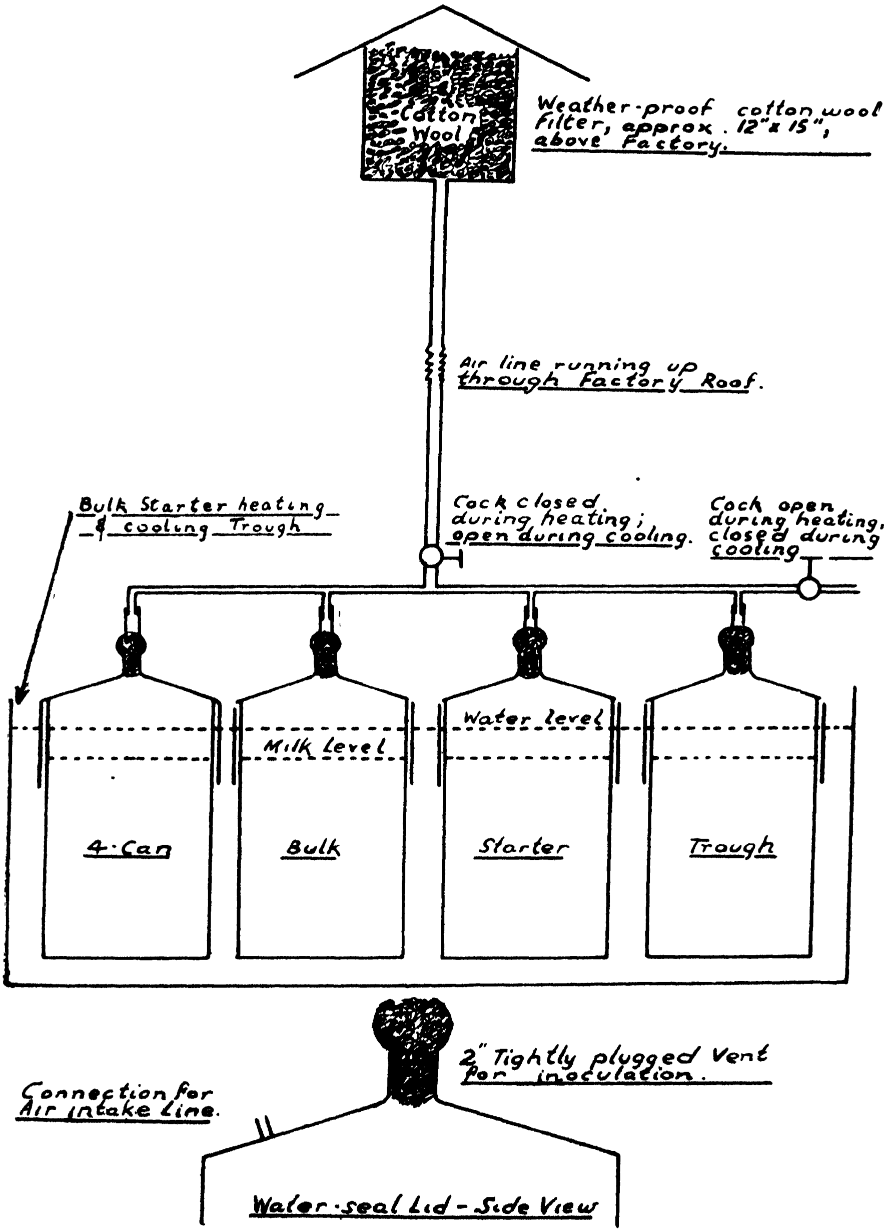


Plate 128.

DIAGRAM OF WATER-SEAL LIDS WITH FILTERED AIR INTAKE FOR BULK STARTER CANS.

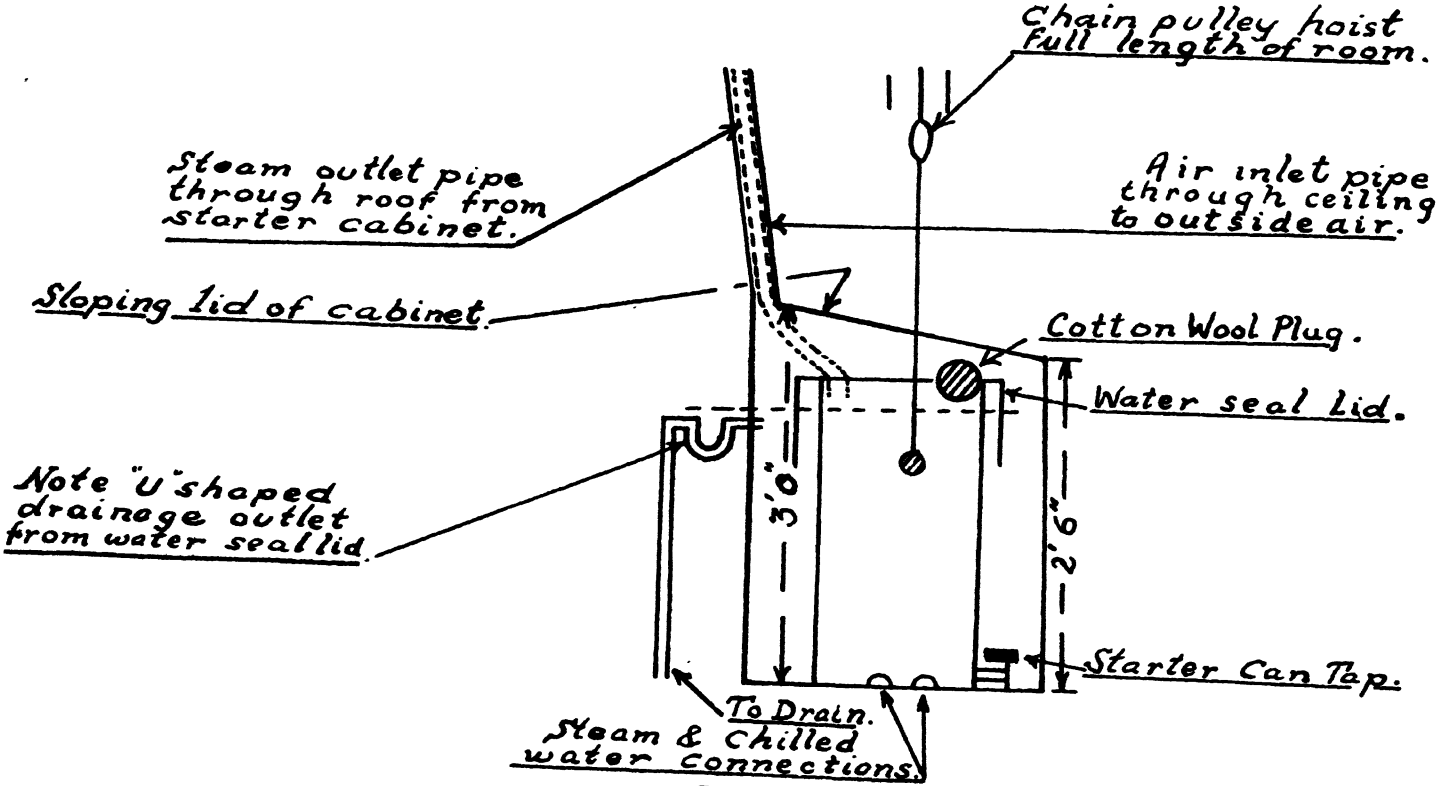


Plate 129.

DIAGRAM (NOT TO SCALE) OF A STEEL BULK STARTER CABINET, SHOWING A TYPE OF AIR INLET THROUGH WATER-SEAL LID TO BULK STARTER CAN.

inoculated by pouring the mother starter through the aperture in the water-seal lid of the bulk starter can, using about three-quarters of a pint (16 oz.) to each can in order to have the starter clotted and ready to use in the cheese vat next morning. The cotton wool closure of the pipe on the water-sealed lid should be immediately replaced after flaming. The bulk starter should be kept at 70-75 deg. F. during ripening.

Bacteriophage in Relation to Cheese Starters.

Single-strain starters produce acidity more uniformly during cheesemaking than mixed cultures. However, sudden failures of single-strain cultures both in the bulk starter and in the vat were puzzling until New Zealand research workers demonstrated the presence of bacteriophages which are able to destroy susceptible starter bacteria. Specific bacteriophages are usually associated with specific strains of starter bacteria. Bacteriophages are ultramicroscopic and until recently could be recognised only by their effects. When phage gains entrance to a starter culture it gradually develops and may bring about the complete destruction of the starter bacteria. Bacteriophage may survive the pasteurisation temperatures in cheese factory practice and progressively build up until the starter fails.

Research has shown that phage can be airborne or mistborne and that the greatest concentrations of phage are wherever there are concentrations of whey. Mist from whey separators and dust from the ground near whey tanks have proved to be carriers of phage.

As phage is airborne, great care must be taken to see that phage-laden air does not enter the starter culture, particularly the bulk starter which is more exposed to contamination. The following measures will assist in achieving this objective:—

1. The fitting of well-made cotton-wool plugs or rubber bungs to the mother culture flasks and the inoculating aperture in the water-seal lids of the bulk starter can.
2. Using water-seal lids with air inlets and air filters for minimising access of phage during cooling of the bulk starter (Plate 128). Alternatively, the fitting of a simplified bacteriophage filter to the individual bulk starter cans may be useful for small factories using only one or two cans of bulk starter (Plate 130).
3. The non-stirring of the milk during cooling and the culture after inoculation.
4. The checking of temperatures only in the water jackets and not putting the thermometer in the culture milk.
5. Maintaining a water seal throughout heating and cooling by arranging a water outlet in the starter cabinet at the level of the water seal.

Procedures for Controlling Bacteriophage in Factory Starters.

1. Isolated Starter Room.

The isolated starter room has proved successful in keeping phage-free starters, but too much stress cannot be placed on the fact that no system can succeed if the operator is careless. If the cheesemaker enters

the starter room in clothes he has worn in the making room and which have been impregnated with whey mist, he must expect to infect the starter with bacteriophage. If the isolated starter room is to be used as the main control measure, it is *essential* that the operator chlorinate his hands and arms, and change into a clean pair of overalls before entering this room.

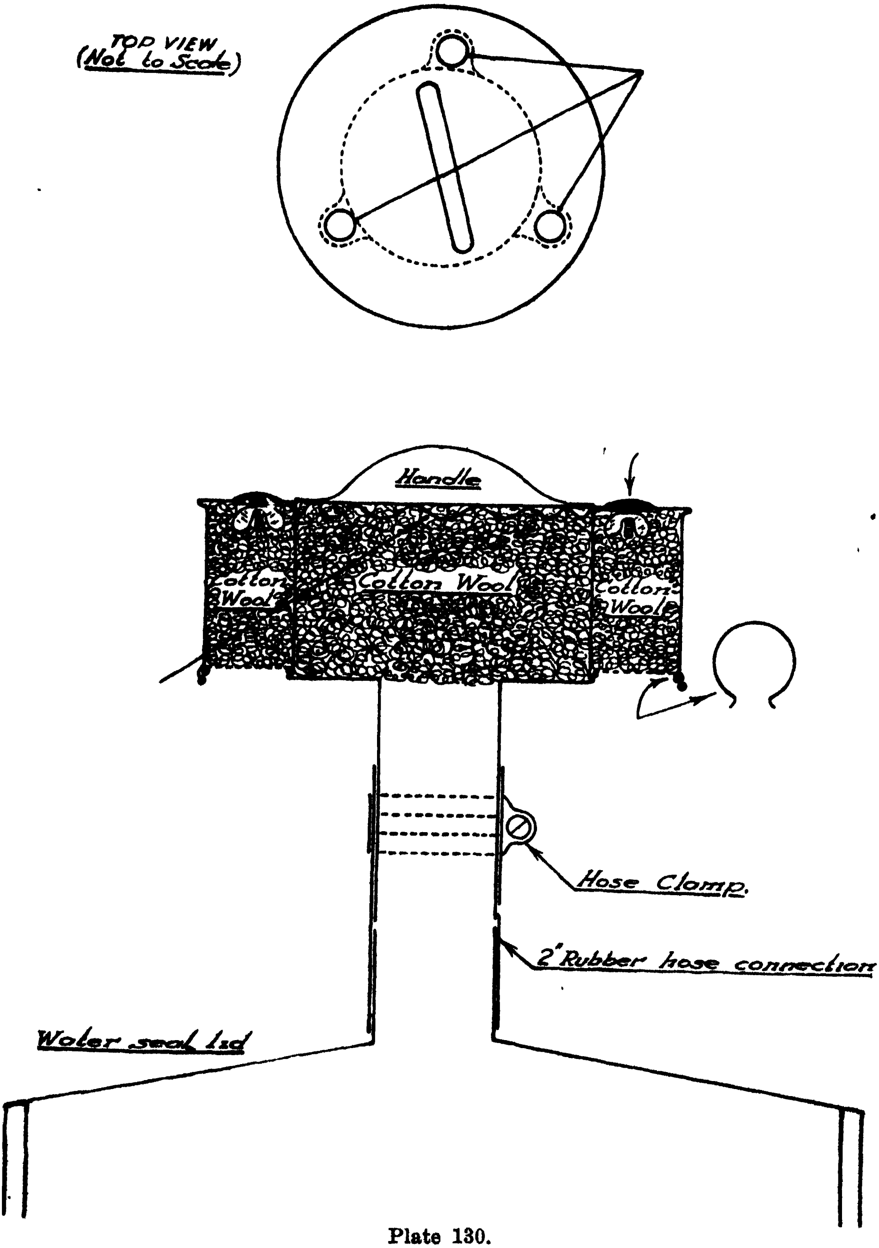


Plate 130.

DIAGRAMS OF A SIMPLIFIED BACTERIOPHAGE FILTER FOR SINGLE BULK STARTER CAN.

The starter room should be suitably aspected with respect to the prevailing wind and in the opposite direction to the whey tank and factory drainage (Plate 131).

Plate 126 shows details of the layout of an isolated starter room. An ante-room is provided for washing-up purposes. It adjoins the bulk starter room so that the only door to the mother-culture room is from the bulk starter room. The mother and bulk milk sterilizers are in the bulk starter room and all controls for steam heating and water cooling are outside the room. This means that once the milk is placed in the sterilizers there is no need to re-enter the starter room until the time for the afternoon sub-culturing. The bulk starter cabinet should be suitably insulated and provided with an external exhaust to which is fitted a tap, which should be closed from the commencement of cooling.

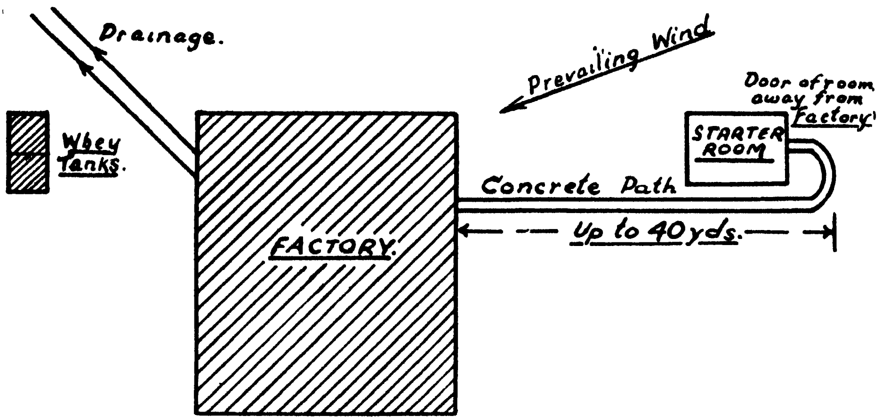


Plate 131.

Diagram Illustrating the Position of Starter Room in Relation to Factory.

All drainage is to an outside sump and all drainage, steam and water outlets are through U pipes, thus preventing the ingress of outside air.

The air should be drawn into the starter room through a suitable series of filters. The doors must be close fitting.

An alternative method (Plate 128) shows filtered air entering each of the bulk starter cans.

The milk for the mother culture should be heated by steam and that for the bulk starter with boiling water.

A hand-trolley and a concrete path make it easy to transfer the bulk starter from the starter room to the factory.

2. Water-seal Lids.

Research has shown that the inrush of phage-contaminated air into the can during cooling of the milk is one of the major causes of phage in the bulk starter. As a protection against this, water-seal lids are used in conjunction with the isolated starter room; or alternatively, in factories which have not built the isolated room, they may be used

independently in a separate room from the making room. These lids completely cover the top of the bulk can and project down into the boiling water. A water-seal lid is a straight-sided can cover which rests on the shoulders of the can. It has an opening in the top which is plugged with cotton-wool and is sufficiently large (2 inches in diameter) for convenient inoculation of the bulk starter. To protect the cotton-wool from moisture, a metal cap is fitted over the pipe in which the cotton-wool is packed. The lid is also fitted with a ½-inch pipe which has a filter fitted to its extreme end through which outside air is drawn or alternatively the special filter (Plate 130) is fitted if air is drawn from inside the factory.

In actual operation the air above the milk in the can is driven out by steam during the boiling-up process. As soon as cooling starts the steam inside the water-seal lid condenses and a partial vacuum is formed. This is relieved by air drawn in through the ½-inch pipe, thus preventing any likely contamination by phage-contaminated air within the factory. The bulk starter is inoculated by removing the cotton-wool plug after flaming and quickly pouring the mother starter in from the Erlenmeyer flask. Inoculations may also be made by pouring through flame or steam. The cotton-wool plug is replaced immediately after inoculation and the water-seal lid allowed to remain in place until the starter is required. This method has been used successfully for the protection of bulk starter in Queensland factories, but it has been found necessary to keep the mother culture away from the factory to avoid contamination from airborne phage.

3. Chlorination.

In overseas countries it has been claimed that an atomised spray (5 ml. of a 10 per cent. solution of available chlorine per 1,000 cubic feet) will kill airborne phage in mother and bulk starter rooms in two minutes. This spraying must be carried out at least half an hour before cooling of the milk begins and again half an hour before subculturing. Care must always be taken to see that contamination is not carried into the room on clothes or hands.

This treatment could be used in conjunction with the isolated starter room or water-seal lids, although if good technique is used it should be unnecessary.

4. Oil-seal.

A layer of paraffin oil on the top of mother and bulk starters has been reported to prevent the ingress of phage provided condensate is not allowed to run through the oil into the culture. Trials in Queensland indicate that it is difficult to avoid condensate and thus the system cannot yet be recommended.

Further Precautions to Control Phage.

In addition to keeping the mother and bulk cultures free of phage it is essential to reduce the incidence of phage in the factory and surroundings. Routine factory control should include the following measures:—

1. All whey should be heated to at least 180 deg. F. before being returned to farmers.

2. Whey tanks, delivery lines and taps should be thoroughly cleaned and sterilized daily.

3. As pasteurising temperatures used for cheese milk (156-160 deg. F. for 10-15 seconds) do not kill phage, all cheesemaking plant and equipment should be thoroughly sterilized each morning. This can be done by circulating a chlorine solution containing at least 200 parts per million, for at least 2-3 minutes, through the weighing vat, chutes, pasteuriser, cooler, intake and making vats. Care should be taken to see that all parts of the making vats, agitators, curd knives, rakes, forks, &c., are adequately treated. Sterilization can be carried out by using boiling water or steam, but chlorination is convenient and less expensive for this type of equipment. Finally, the used chlorine solution should be circulated through the whey drains and sump or ejection lines.

4. Whey tanks should be away from the factory and whey separators installed in a separate room apart from the cheesemaking room. This reduces the risk of a "build-up" of phage from whey mist.

5. Four phage-specific starter strains should be used in daily rotation to prevent the build-up of strain-specific phages.

Defects of Starter.

1. *Contaminated Culture.* Faulty methods of propagation may cause contamination with the gas-forming coliform bacteria and yeasts and moulds, which can tolerate the acidity developed by starter. The effect on the mother culture may be observed through the Erlenmeyer flask before the flavour is affected. Careful propagation avoids this type of contamination.

2. *Loss of Vitality.* This may show by a gradual slowing of the rate of acid production in the vat, which delays manufacture, and leads to weak body and off flavours in the cheese. It is due to loss of vigour of the starter bacteria. Affected cultures should be renewed immediately.

3. *Malty Flavour.* Sometimes starters develop a malty flavour due to development of a malty-flavoured strain of *S. lactis*. Cultures showing this condition should be rejected.

4. *Ropiness.* A starter may develop ropiness. The condition usually first occurs on the surface of the starter. In such an event a few subsequent propagations made from inoculum obtained near the bottom of the Erlenmeyer flask may eliminate the defect.

5. *Curdy Starter.* This defect is due to oversetting or holding at too high a temperature. It may be avoided by reducing the quantity of inoculum or incubating the starter at the desired temperature of 70-75 deg. F.

6. *Bacteriophage and Non-Acid Milk.* When the starter fails or acid production is slow, samples of whey should be forwarded to the laboratory for examination and report. The laboratory will assist factories to effect control by determining phage specificity and recommending a suitable rotation of starters.

Hand-feeding Sheep in Drought Time.

G. R. MOULE, Officer-in-Charge, Sheep and Wool Branch.

INTRODUCTION.

IT is well known that drought occurs frequently, though somewhat irregularly, in pastoral Queensland and as a result heavy losses have been experienced by the sheep industry in this State.

Occasionally conditions warrant hand feeding of sheep in drought-stricken areas and this article has been written to assist sheep raisers in planning drought feeding. It is not suggested that hand feeding is the answer to drought in Queensland. There is no one answer to the problem, though one or more of several methods may be adopted to mitigate its effects.

However, where feeding is practised, care in the selection of the ration will save very considerable sums of money and accordingly it is important that woolgrowers should have the most recent information about the selection and feeding of drought rations.

INDICATIONS FOR DROUGHT FEEDING.

The woolgrower whose country is drought stricken may consider one of several methods of meeting the situation. These include:—

(i.) Moving of sheep to agistment;
(ii.) Feeding edible scrub;
(iii.) Hand feeding;
(iv.) Selling part or all of the flock; and
(v.) Allowing the sheep to take their chance in the paddock.

Naturally, economic factors will influence the final decision and either agistment or scrub feeding is usually the cheapest method. However, the more valuable edible trees and shrubs such as mulga are restricted in their distribution and there is a very large part of Queensland where scarcity of top feed makes scrub feeding impossible.

At the same time, suitable agistment areas are not always available and even if they do exist it is often impossible to move the sheep to relief pastures.

When this occurs the owner has to decide which of the other three methods he will adopt and to what extent he will use the one selected. Hand feeding can be most expensive and it is often the most disappointing because heavy losses of stock may occur after the rains fall. However, the efficiency with which the available food is utilised by the animals depends largely upon the management of the property. Accordingly, in making a decision about hand feeding consideration has to be given to:—

(i.) Which sheep will be fed?

(ii.) What is the market value of the sheep?

(iii.) What is likely to be the market value of the sheep at the end of the drought?

(iv.) For how long is it probable the feeding will have to be undertaken?

(v.) What is the availability of foodstuffs, and are supply, transport and labour assured?

(vi.) What will be the cost of feeding?

The answer to question (i.) is obvious; the young breeding ewes must get first preference. From them the flock can be rebuilt when the drought breaks. The answer to questions (ii.) and (iii.) depend on conditions at the time. If the prospect is for a well sustained wool market it is likely that the sheep will maintain their value. If, however, the wool market falls suddenly sheep would tend to lose value quickly.

No accurate forecast can be made about the time it may be necessary to feed sheep. It is seen from Table 1 that in the central-west and north the summer rains are more reliable than winter falls. However, because of the unreliable nature of the summer rains in that area the country between (and including) the Winton and Isisford districts has experienced more and longer periods of drought than any other. Isisford,

COMMENTS ON TABLE 1.

This table shows, for a number of centres, the monthly average rainfall (Av.) in points for the centre, the "effective rainfall" (E.R.) in points for each month, the percentage reliability (P.R.) of the effective rainfall on a monthly basis, and the number of years on which records are based (in brackets).

The "effective rainfall" is the number of points which may be needed to stimulate plant growth. It is determined from studying the ratio of rainfall to evaporation. In interpreting these data for Queensland conditions due regard must be given to the reliability of the summer rains, as this is predominantly a summer rainfall country and in most districts the heaviest growth of grass occurs during normal summer seasons.

In some districts there is a plant community, commonly referred to as "herbage," which responds well to winter falls. In a light season herbage can bring useful but sometimes comparatively short-lived relief. Because of herbage comparatively light winter falls may be useful in the southern part of the State, though they would be useless in the north.

The "effective rainfall" for summer months can be regarded as being a close indication of the rainfall requirements to bring relief in any one month, though it would not assure "a season." Obviously, follow-up rains would be necessary, and after a long dry spell constant summer rains would probably be necessary to re-establish Mitchell grasses.

One other factor which has to be taken into consideration is the damage which can be done in the winter to a body of Mitchell grass, which is "standing over" from the summer, by light falls of from 20 to 30 points. It is well known that these may cause the feed to deteriorate rapidly and can produce a drought threat almost overnight.

TABLE 1.

Centre and No. Years' Record	Index.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
Camooweal ..	Av.	53	124	208	361	343	199	41	31	61	28	14	21
(57)	E.R.	300	256	250	224	182	240	236	211	154	168	211	236
	P.R.	3	12	37	49	75	35	3	3	17	7	2	2
Cloncurry ..	Av.	45	128	279	442	411	233	70	45	62	34	15	29
(64)	E.R.	308	259	256	234	208	248	248	226	173	168	225	244
	P.R.	2	17	34	62	64	39	11	6	14	9	3	2
Richmond ..	Av.	61	131	252	444	387	217	77	57	74	42	11	24
(59)	E.R.	284	243	237	198	170	212	204	178	134	149	197	220
	P.R.	5	19	47	68	75	41	15	14	20	10	0	3
Kynuna ..	Av.	63	124	237	332	309	191	62	54	79	46	15	31
(55)	E.R.	256	227	234	202	173	212	196	168	115	115	168	188
	P.R.	2	16	29	58	67	27	11	11	22	16	4	4
Winton .	Av.	77	129	184	315	311	209	67	62	83	64	22	41
(64)	E.R.	268	243	250	230	196	224	200	173	125	125	173	204
	P.R.	5	17	23	47	58	34	14	19	22	25	3	6
Hughenden ..	Av.	86	126	263	454	366	212	105	60	88	48	30	41
(64)	E.R.	256	224	214	170	150	176	168	158	110	120	168	184
	P.R.	8	23	42	74	78	42	19	14	23	19	5	9
Longreach ..	Av.	97	115	181	212	338	239	95	85	87	80	28	57
(55)	E.R.	236	205	221	208	176	196	148	149	96	106	144	172
	P.R.	11	22	33	36	51	33	25	18	29	29	7	9
Isisford ..	Av.	103	133	189	240	278	263	134	99	109	92	54	63
(63)	E.R.	224	208	205	211	179	204	164	139	101	106	144	160
	P.R.	14	27	30	35	52	37	25	29	32	30	8	16
Barcaldine ..	Av.	140	134	224	322	280	258	142	115	114	100	55	68
(62)	E.R.	224	192	198	196	163	196	156	139	96	101	139	164
	P.R.	19	26	40	55	50	36	29	34	43	32	13	16
Alpha ..	Av.	125	175	264	364	302	236	139	102	151	102	74	88
(62)	E.R.	200	184	184	170	148	180	150	132	93	93	132	150
	P.R.	21	42	52	76	60	40	31	29	56	29	26	24
Blackall ..	Av.	139	151	241	285	320	267	134	136	125	112	66	77
(68)	E.R.	224	202	218	214	182	196	164	125	86	91	130	156
	P.R.	23	28	43	50	59	43	29	37	47	41	21	19
Tambo ..	Av.	135	181	251	283	297	260	139	135	129	120	74	86
(65)	E.R.	188	173	186	179	150	168	140	110	72	77	110	144
	P.R.	31	38	55	66	68	51	29	40	57	46	26	23
Augathella ..	Av.	141	187	258	299	280	292	142	119	158	124	77	96
(59)	E.R.	190	180	200	192	170	180	140	108	69	72	114	140
	P.R.	25	39	58	58	51	47	34	44	59	56	27	22
Charleville ..	Av.	125	164	236	247	264	227	135	122	135	123	77	84
(67)	E.R.	196	189	205	208	186	192	148	110	67	72	115	140
	P.R.	22	34	49	42	49	37	31	39	60	48	33	21
Clermont ..	Av.	131	207	374	505	415	306	158	129	168	107	68	97
(78)	E.R.	215	196	192	172	140	170	150	138	96	96	132	160
	P.R.	25	49	68	79	70	59	43	33	55	36	17	23
Emerald ..	Av.	146	208	333	418	326	289	139	107	167	113	86	112
(65)	E.R.	210	184	184	172	152	170	150	144	102	102	132	160
	P.R.	25	54	71	71	69	55	32	25	52	34	28	28
Springsure ..	Av.	165	232	320	420	375	294	152	123	175	121	101	126
(83)	E.R.	205	184	180	172	156	185	165	162	114	120	150	165
	P.R.	36	54	71	76	70	54	34	28	49	31	28	27

TABLE 1—*continued.*

Centre and No. Years' Record	Index.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
Mitchell ..	Av.	145	219	274	294	298	277	136	126	163	145	94	122
(64)	E.R.	189	180	191	191	169	166	122	97	59	65	103	130
	P.R.	34	56	62	52	52	59	44	47	72	66	37	30
Roma ..	Av.	173	216	250	311	283	268	128	143	153	145	89	138
(76)	E.R.	184	176	184	184	166	175	135	103	65	65	103	126
	P.R.	42	51	61	63	58	53	37	47	63	61	35	35
St. George ..	Av.	131	176	204	259	231	216	133	144	153	125	95	106
(67)	E.R.	180	173	184	220	180	180	162	113	70	65	103	122
	P.R.	30	37	46	48	48	45	27	40	63	57	33	33
Bollon ..	Av.	129	148	214	226	193	176	112	120	146	106	94	102
(63)	E.R.	180	176	191	205	180	180	126	103	65	59	92	122
	P.R.	24	36	49	49	38	32	38	36	67	62	43	31
Dirranbandi ..	Av.	120	161	217	226	196	188	124	134	157	111	86	102
(60)	E.R.	182	174	190	214	192	192	132	102	92	63	99	128
	P.R.	22	38	48	37	38	40	30	38	63	62	33	37
Talwood ..	Av.	153	215	250	230	221	184	121	159	163	137	89	101
(35)	E.R.	168	164	180	192	168	178	120	96	66	60	90	118
	P.R.	37	57	57	54	46	46	37	49	80	66	40	43
Miles	Av.	203	263	306	368	260	270	148	151	174	164	113	131
(63)	E.R.	162	148	155	151	130	144	112	97	65	70	97	122
	P.R.	56	70	76	79	71	63	52	54	75	68	43	43
Surat	Av.	174	182	269	273	291	257	122	127	175	173	101	123
(67)	E.R.	158	151	169	173	155	158	126	103	65	59	92	117
	P.R.	43	43	67	66	58	54	39	48	72	72	42	45
Goondiwindi ..	Av.	175	225	291	297	249	252	147	171	177	174	125	151
(69)	E.R.	158	155	176	169	151	162	117	92	59	59	86	112
	P.R.	46	59	69	67	61	51	49	61	74	75	52	58
Taroom ..	Av.	182	307	321	407	310	270	150	165	171	145	111	138
(78)	E.R.	174	155	158	156	124	156	120	104	70	75	155	174
	P.R.	46	70	74	74	71	59	44	45	60	50	26	33
Cunnamulla ..	Av.	88	105	153	131	208	138	106	115	118	88	70	82
(69)	E.R.	196	198	208	224	192	200	144	110	72	67	110	140
	P.R.	10	17	30	20	43	25	27	33	58	42	17	19
Wyandra ..	Av.	88	122	180	151	198	157	89	86	130	115	66	102
(50)	E.R.	190	194	212	222	194	200	150	114	69	72	114	140
	P.R.	14	16	38	26	38	24	26	30	68	48	20	26
Quilpie ..	Av.	59	93	141	122	119	73	119	82	105	61	35	53
(31)	E.R.	220	228	248	264	244	240	170	129	84	90	129	160
	P.R.	3	16	16	16	19	10	26	19	45	29	16	19
Eulo	Av.	76	98	132	127	151	127	78	80	117	83	68	61
(62)	E.R.	210	210	222	246	214	220	160	144	78	72	117	150
	P.R.	8	15	19	16	32	21	19	23	52	32	18	19
Adavale ..	Av.	102	125	178	229	201	181	96	104	124	93	52	64
(59)	E.R.	224	224	240	250	234	232	164	130	82	91	130	160
	P.R.	10	19	34	29	34	32	22	27	49	30	12	17
Boulia ..	Av.	49	95	122	163	193	147	56	43	54	32	20	31
(62)	E.R.	292	269	285	278	253	276	224	182	125	125	173	212
	P.R.	3	16	13	21	34	19	11	6	13	11	5	2

for instance, had 11 unfavourable years in succession, while Winton, on one occasion, experienced four consecutive years in which no useful rain fell. Hand feeding under these circumstances would have been impossible

Should summer rains fail, as they frequently do, the chances of relief during the winter are better in the southern part of the State than in the north, and it is interesting to note the difference between the reliability of the winter rains at Tambo and Blackall and Barcaldine and Longreach, but the possibilities of a prolonged dry period, with repeated failures of summer rain, should not be overlooked.

However, an owner who gets his flock through the earlier part of the year fairly well despite inadequate summer storms and failure of winter rains is often faced with a difficult decision by about August or September. He may feel that summer storms may commence during November and bring relief or, at the very worst, general summer rain should come by February or March. In these circumstances consideration might well be given to commencing hand feeding in the spring. Should this be done, property owners in the central and north-west would be well advised to discontinue feeding if relief rains do not fall by the late summer. The probability of winter rains in that area is low and it is inadvisable in most circumstances under pastoral conditions to attempt hand feeding for more than six or seven months.

The location of the property, with special reference to distance from the railway line, has to be considered. Haulage and transport costs can make drought feeding most expensive. Finally, it must be remembered that drought feeding calls for attention to an infinite amount of detail; failure to attend to details may mean failure of the whole project.

[TO BE CONTINUED.]

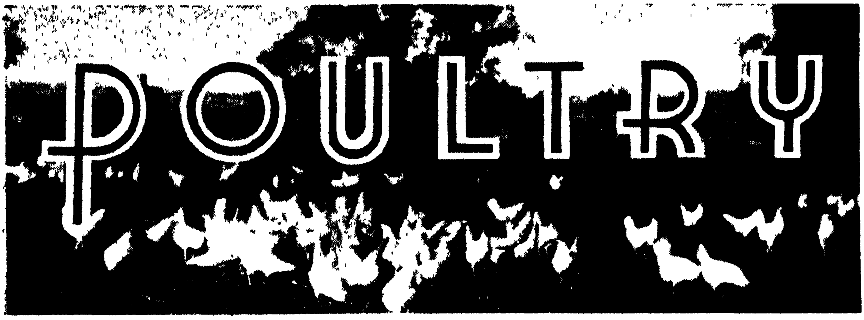
LONG-WOOL RAM SUBSIDY SCHEME.

The Minister for Agriculture and Stock (Hon. H. H. Collins) has announced that applications for assistance under the Long-Wool Ram Subsidy Scheme have now closed, since the maximum number of purchases to be subsidised during the current financial year has been reached.

The scheme was initiated to assist sheep raisers in the purchase of up to 400 long-wool rams suitable for crossing with Merino ewes for the production of fat lamb mothers. Mated with Dorset horn or Southdown rams, these crossbred ewes will produce fat lambs of high quality.

In the purchase of rams under the scheme, preference was given to Queensland studs, and 85 per cent. of the subsidised rams were bred in the 23 long-wool studs in this State. About two-thirds of the rams were Corriedales, one-quarter Border Leicesters, and the remainder Romney Marsh.

Mr. Collins said that consideration would be given to reintroducing the subsidy scheme in the next financial year.



Poultry Keeping on the General Farm.

P. RUMBALL, Officer-in-Charge, Poultry Branch.

POULTRY raising is now a very definite and important branch of primary industry. This is due largely, in the first instance, to the labours of the specialist breeder in the production of high producing strains; secondly, to modern methods of production and distribution of chickens; thirdly, to more efficient and organised marketing; and lastly, to the adoption by poultry raisers of scientific methods of feeding.

Although the specialist poultry breeder has an important influence on the maintenance of a highly organised and efficiently conducted industry, considerable quantities of eggs are produced on the general farm, and if the poultry industry is to expand, such expansion would be sounder as a part of general farming than as a specialised industry.

During recent years there has been a very definite increase in the production of eggs, as indicated by ever-increasing quantities exported overseas. Overseas export, however, can only be practised during a few months of the year. Fortunately for the industry, this period corresponds with the period of peak production, offering a ready means of dealing effectively with the surplus production which usually occurs over that particular period. There is, however, no definite break in production after the export season closes; consequently supplies are temporarily in excess of home requirements, and storage for winter use has to be provided.

The first cost of the egg with the added storage charge prevents eggs so treated being sold at prices that will encourage greater consumption; consequently there is a limit to the number of eggs that can be stored for winter use.

Expansion of the industry must march with increased local consumption, and this is only possible by establishing in the consumers' minds a greater appreciation of the food value of the egg than has been the case in the past.

The confidence of the consumer depends largely on the producer. The fowl produces an article of diet invariably in an almost perfect condition. It therefore remains for the producer, for his own protection, by the exercise of care and efficiency to maintain it in this condition.

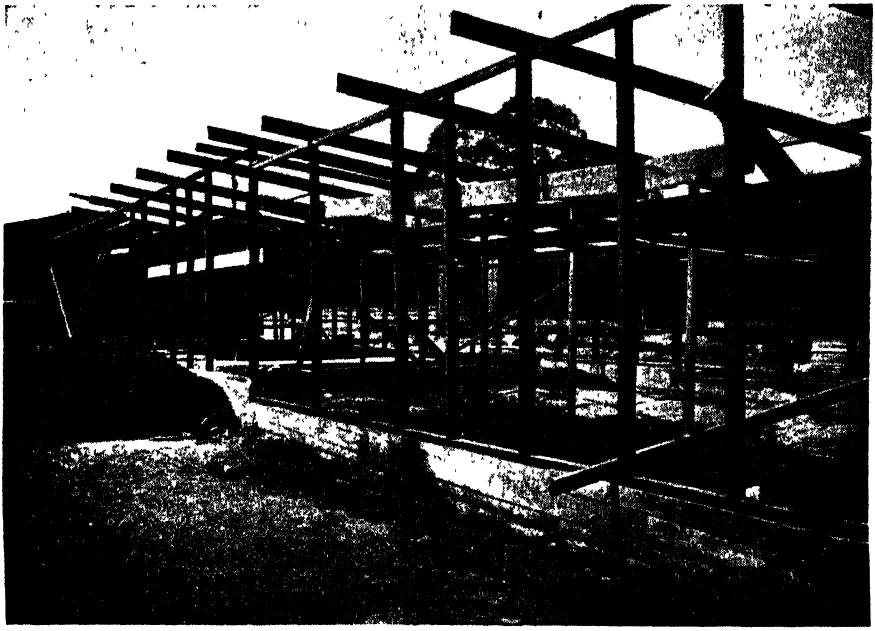


Plate 132.
INTENSIVE POULTRY HOUSE IN COURSE OF CONSTRUCTION.—Note concrete baffle wall to keep rats from under the floor.

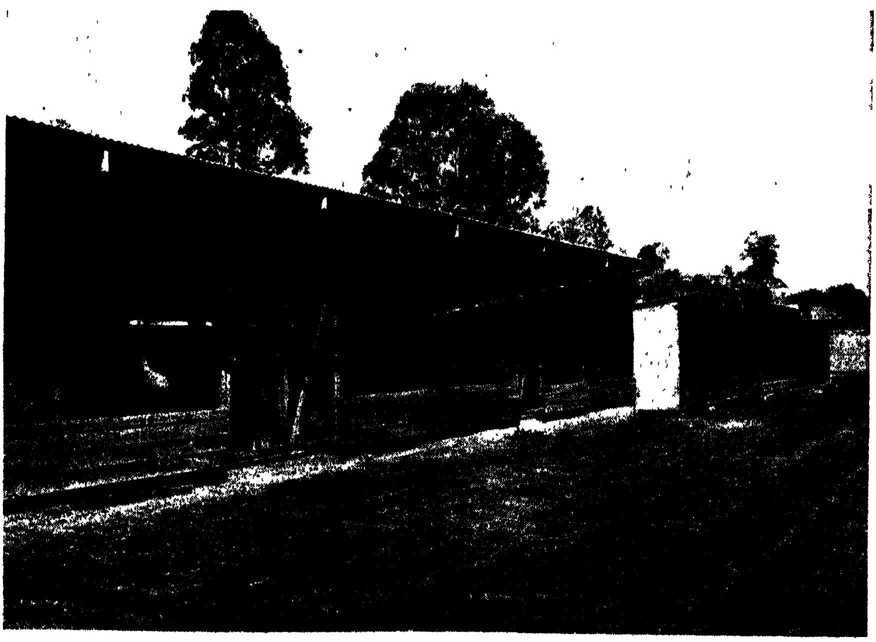


Plate 133.
INTENSIVE POULTRY HOUSE COMPLETED.

HOUSING.

To obtain the best results from poultry, good housing is as necessary as good stock, good feeding, and good management.

Elaborate housing is not necessary, but it must have correct ventilation, freedom from draughts, freedom from moisture, and sufficient room for the comfort of the birds.

Poultry houses may be built of a variety of materials and of many shapes, or old sheds or barns may be converted. If a new house is to be built, iron and sawn timber are recommended as being the most suitable materials (see Plates 132 and 133). The subject is dealt with separately in a Departmental pamphlet.

Systems of Housing.

Housing systems commonly adopted are:—

(1) Intensive, where the birds are kept entirely under cover;

(2) Free range, where a house is erected to provide sleeping accommodation and unrestricted liberty is permitted; and

(3) House and yard, where a house is provided for sleeping quarters, and liberty is restricted by a netted run.

Under the intensive system, the birds are afforded the maximum protection from the weather, ensuring a greater stability in production. The health and condition of the birds are readily observed by the farmer. Further, it is possible to remove all excreta from the house at regular intervals.

Under the free range system some soil contamination from the excreta of the stock naturally takes place, but, because of the unrestricted range and the feeding on the soil by plant life, soil contamination does not become serious. The birds are, however, exposed to the vagaries of the weather, and egg production is not as stable as under the intensive system. There is, however, compensation in the reduced cost of feeding, as birds on range gather a good deal of food in the form of insect life, grass seeds, and other materials.

The house and yard system has the disadvantages and none of the advantages of both free range and intensive system. The birds are exposed to the weather as much as they are under free range, and cannot gather food as the netted run becomes bare in a very short time. The most serious disadvantage of this system, however, is the soil contamination of the pens.

Where a large flock is to be kept the intensive system of housing is recommended, but for the farmer keeping 50 to 100 birds the free range system offers many advantages.

The Site.

The intensive system requires a large and permanent structure, sc the site chosen should receive due consideration. As many poultry raisers start in a small way, provision should be made for extensions.

In addition, although concrete flooring is recommended, the position chosen should be well drained, and, if the building is to be erected on relatively flat ground, the floor should be raised several inches above the surrounding land surface and well rammed to provide a solid foundation.

The house should face north or north-east. A northerly aspect permits of the maximum penetration of the sun's rays into the house during the winter and the minimum during summer.

BREEDS.

Commercial poultry may be grouped in three classes, namely, light, heavy or dual purpose, and game.

Light Breeds.

Light breeds are usually developed especially for egg production with little or no regard to table qualities. This type of bird may also be classed as a non-sitter. Among many strains individuals will be found in which the broody trait has not been bred out, but taken collectively they may be classed as non-sitters. Another character of the light breeds is that they are layers of white-shelled eggs.

Among this group Leghorns predominate, with probably the Ancona next in favour, followed by the Minorca.

Heavy or Dual Purpose Breeds.

Heavy or dual purpose breeds have been developed for table and egg-producing qualities. As a group they are not as efficient egg producers as the light breeds, but individuals hold the record as egg producers in Queensland, namely, 354 eggs in 365 days. Without exception all heavy breeds are very docile, whereas light breeds are of a more or less nervous disposition. Breeds of this group may also be regarded as sitters. Every effort is being made to breed this characteristic out, and it has been done to some considerable extent, but in the best of flocks broody hens will be found. The eggs of this group should be brown in colour, although many pale eggs are laid by all breeds.

The most popular breed of this group is the Australorp. The Langshan is probably the next in favour, followed by the Wyandotte, Rhode Island Red, and Sussex.

Game Breeds.

Game breeds are essentially table birds. Although it may not be profitable to breed Game fowls for table purposes, if it is found commercially sound to breed birds exclusively for the table the crossing of any dual-purpose fowl with the Game will add remarkably to the table qualities of the progeny. This appears to be the most profitable use for Game fowls.

Among the Game group are the Old English, Indian, and Australian Game.

STANDARDS.

To maintain breed characteristics it is essential to have standards to which to breed. Thousands of fowls are bred yearly by producers with little or no regard to type. The departure from type may be attributed in some degree to the exaggerated specimens seen at times on the show bench, and to the greater consideration given by some judges to feather markings than to type and egg-producing qualities.

From the one breed there has often been developed two types, namely, the standard-bred fowl and the utility-bred fowl. In trying to perfect his bird from a show point of view the fancier sacrificed egg qualities, while the egg specialist in the race to produce eggs sacrificed

type. The egg producer sacrificed type to such an extent that commercial breeders years ago drew up a utility poultry standard to be read in conjunction with the standard of perfection as laid down by the Poultry Club of England. This move has proved of great advantage to the industry, in as much as the improvement in type which has developed has materially assisted in maintaining the health and stamina of the flocks.

Utility Poultry Standard.

Type, colour (plumage and lobes), legs and feet (colour), condition (health, furnishing brightness and cleanliness of feather and legs), all in accordance with the accepted standard of the breed.

Plate 134.

MEASURING THE DISTANCE BETWEEN THE PELVIC BONES AND THE KEEL.

Laying Characteristics, any Breed.

Conformation—Length, depth and width proportionate to type of breed. Length is taken from base of the neck to base of the tail. Depth is determined by the vertical space between the back and the breast-bone and the pelvic bones. Width is measured across the saddle and immediately behind the wings and is indicated by the distance apart of the legs.

Freedom from Coarseness—

(*a*) Shanks strong, as differentiated from either extreme coarseness or fineness of bone.

(*b*) Pelvic bones strong at base, long, fine, and straight.

(*c*) Tissue—pelvic bones to be as free as possible from gristly covering.

Head.—Finely modelled; skull deep over eyes, full and round at back.

Eyes.—Full, bright, and expressive.

Face.—Bright, lean, free from feathering, and not sunken.

Comb and Wattles.—Neat, fine in texture, and medium size, without "beefiness."

Neck.—Fine and fairly long.

Skin and Abdomen.—Texture of skin to be of the thinnest and finest quality and pliable; abdomen to be elastic, avoiding sagging-in and/or fullness indicating excess of fat.

Plumage.—Feathers soft and silky, close, but not hard as in Game; fluff moderate.

Weights.—Light breeds, ½ lb. to 1 lb. above minimum, and heavy breeds 1 lb. to 1½lb. above, score maximum points; if in excess to be cut correspondingly.

Minimum Weights.

Light Breeds.

Leghorns, Minorca, Andalusians, Spanish, Campines, Buttercups, Anconas: cockerel, 5 lb.; pullet, 4 lb.

Hamburg: cockerel, 4 lb.; pullet, 3 lb.

Heavy Breeds.

Australorp, Plymouth Rock, Rhode Island Red, Sussex: cockerel, 7 lb.; pullet, 5 lb.

Langshans, Wyandottes: cockerel, 6 lb.; pullet, 4½ lb.

Any other variety: cockerel, 7 lb.; pullet, 5 lb.

Scale of Points.

Standard Points.—Type, maximum points, 20; colour (plumage and lobes), 7; legs and feet (colour), 3; condition, 5.

Laying Characteristics.—Conformation (indicating stamina and capacity), maximum points, 20; freedom from coarseness, 5; head, 7; eyes, 7; face, 6; comb and wattles, 5; skin and abdomen, 5; plumage, 5; weight, 5; total 100.

Disqualification.—Under-weight, wrytail, any indications of impurity of breed, dubbing, and faking.

CULLING.

Even with the best of stock unprofitable birds will be reproduced, and culling becomes necessary. By culling the cost of production is reduced, and greater accommodation is available for the stock retained.

In egg-laying competitions an average individual production of 200 or more eggs is usual. This average is not impossible for the poultry raiser to obtain from a flock of well-managed pullets. However, in the second year of a hen's life production is much lower than in her first. Some excellent first-year producers may be exceptionally poor in their second. A similar relationship exists between the production of the second and third year, but with the difference that third-year birds invariably do not lay enough eggs to warrant their retention in the flock.

Culling, therefore, in the first instance revolves around the disposal of old hens. This being so, it is essential that there should be some means of identification by banding birds or by toe-marking. With the latter system it is necessary to catch the bird and inspect its feet to determine its age.

In addition to culling for age, all obviously unfit birds, from chickens to the oldest hens, should be removed from week to week. The main culling should be practised in the summer.

Before culling, the conditions under which birds are housed and fed should be considered. Only well-treated birds can have the external features of a good layer. If the treatment has not been correct this should be remedied, and the birds given at least 6 weeks to respond.

Well managed and regularly culled flocks require little culling during the summer, apart from culling for age. In badly bred and poorly managed flocks considerable culling is necessary. Hens that have given two years' production should, with few exceptions, be culled for age.

Birds should be examined on the ground first. A good producer should be bright, alert, and active, and should have length, width, and depth of body. Birds without these characteristics should be rejected. All small, undersized birds, although of active appearance, should be removed. This work may be done best in the fowlhouse. The birds should be caught with a fish landing net. The other birds should be handled; the best way to catch them is to round them up in a corner, using a piece of 6-feet netting, enclosing 20 to 30 at a time. In the further examination it must be borne in mind that a moulting bird will not have the same measurements as a laying hen. On handling the bird, first its weight should be noted. A good producer will be lean, but not light. Exceptionally light birds should be rejected.

The examination procedure should be based on the following (see Plates 135-137) :—

GOOD LAYER.	POOR LAYER.
Comb (hen not moulting).	
Full, smooth, red, and waxy.	Limp, small, covered with white scale.
Head and Face.	
Lean, fine bone, inclined to length; smooth face.	Coarse-heavy bone; short, dull, and wrinkled face.
Eye.	
Full, bright, and prominent.	Dull, small and sunken.
Beak—Yellow-skinned Birds.	
White or bleached.	Yellow or yellow at base extending to tip.
Eye-ring—Yellow-skinned Birds.	
White or bleached.	Yellow.
Neck.	
Medium length, fine.	Coarse, short, bully.
Back.	
Flat, long, wide (width extending to tail).	Rounded, narrow, especially at tail.

Plate 135.

HEAD OF A GOOD LAYER.—This is an alert, active bird from whom high egg production can be expected.

Plate 136.

A COARSE HEAD.—This type of head is not associated with high production.

GOOD LAYER.	POOR LAYER.
Body.	
Long, deep both front and rear.	Short, shallow, especially at rear of bird.
Legs.	
Medium length, fine bone, small close scales, toes well spread.	Short and excessively long; coarse round bone.
Feathering.	
Soft and close; when hand placed on bird it will not sink. Good layers frequently bald around head.	Loose, soft; excessive fluff.
Vent (Yellow-skinned Birds).	
White, large, soft, moist, oval, upper part overhanging.	Yellow, small, hard, dry, and round.
Pelvic Bones.	
Thin, pliable, and relatively wide.	Thick, blunt, and close.
Abdomen.	
Loose; skin pliable, soft; full when in lay and deep from pelvic bones to keel.	Tight, hard, tucked up; pelvic and keel bones close.
Moult.	
Late and rapid, many laying and moulting.	Early, slow.

Plate 137.

HEAD OF A GOOD LAYER.—Note the alertness and freedom from coarseness. Baldness is frequently associated with high production.

[TO BE CONTINUED.]

When Should Baby Start Talking?

Young mothers who have had little or no experience of children before their own babies arrive find themselves confronted with many problems. Feeding troubles are the most obvious ones. Other very usual "worries" centre round the ages at which baby should sit up, talk, walk and develop various other skills.

Speech is a mode of expression universal in man and by it the development of his intelligence is often judged, and so parents after carefully reading up the *average* age at which baby should commence to say words are worried because their baby is not doing so while perhaps the infant next door has been talking for some time.

The important thing which mothers and fathers must realise is that baby *understands* words long before he forms and uses them. He may show he does so by kicking and cooing when his feeding time is mentioned or pointing when asked where is his little brother or the puppy. Learning to associate words with things and situations will proceed slowly or quickly according to the opportunities provided by the mother or guardian who is with the child all day. A baby can only repeat what he hears, so a silent mother makes a silent baby while a mother who is a good commentator on life helps her baby to associate words with the articles to which they belong. In this connection it is well to remember that it is only by constant paintaking effort that faults of speech and pronunciation can be corrected once they have become fixed, so "baby talk" should not be encouraged however "cute" it sounds. If the baby hears from his parents and brothers and sisters badly formed and carelessly spoken words, slang or swearing, the day will come when, like a gramaphone record, he will reproduce these sounds.

Baby begins practising sounds very early in life. He finds it fun to make noises and a baby of 6 months experiments with many more sounds than he will ever use when he settles down to talking. Parents often become quite heated as to whether baby first said "Ma-ma" or "Da-da" but actually these are primary sounds common to all babies and he usually says these about 11 months of age. Other single words follow and by about 18 months he can usually say about six words. At 2 years of age he begins to put several words together to make sentences.

Some quite normal babies are slow in talking because they will "not be bothered." They are usually strong-willed little people and sometimes spoilt as well. They get along quite well with gestures and signs—insisting on being understood. The more they are urged to talk the more silent they remain. There is no need to worry about these children. They will talk when it suits them and talk very well. They often live too much in adult company and it is a good plan to arrange for them to have the company of other children, when they will naturally copy what the others do.

If your child is not talking after he is well past the average age when he should do so it is a good plan to consult your doctor just to make sure that his hearing or natural development is not responsible. The earlier speech defects are taken in hand the sooner will they respond to treatment.

Any further information on this and other matters connected with children may be obtained by communicating personally with the Maternal and Child Welfare Information Bureau, 184 St. Paul's Terrace, Brisbane, or by addressing letters "Baby Clinic, Brisbane." These letters need not be stamped.

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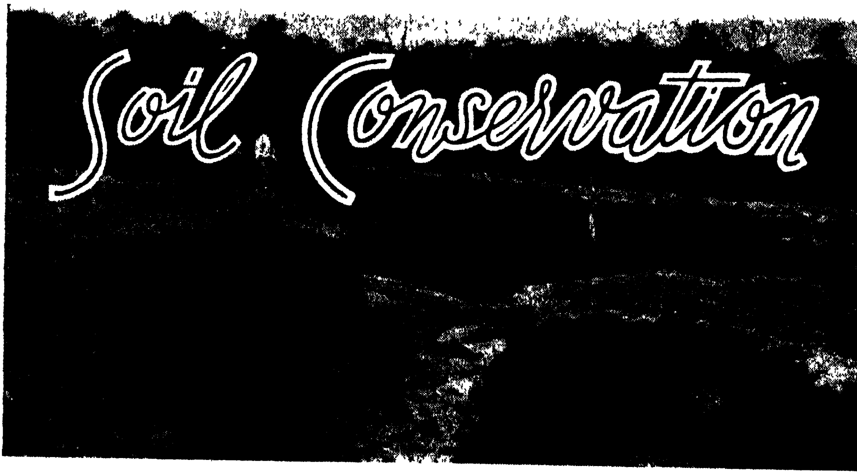
Contents



A Home-made Bulldozer.

H. BIRD,* Tingoora.

IN soil conservation work on my farm, I have used a farm-built bulldozer attachment on a Farmall M tractor and am satisfied that, with minor variations, the attachment would be suitable for other universal-type tractors, though a narrower blade would naturally be used with tractors of lower horsepower. The total cost of the attachment was £35, including purchase of iron and timber, curving of iron, welding and labour.

Plates 138-140 and the drawings show all necessary details. Briefly, the set-up may be described as follows: The transmission of a car differential is attached to the tractor power take-off. One side of the differential housing is shortened by cutting and welding, and a drum is welded to the original wheel base. A hand lever connected to the brake drums permits the brake to be released or applied on either side as required. The drum turns when the brake is applied to the opposite wheel base. A wire rope attached to the drum and operating through pulleys elevates the bulldozer blade to any height required, while release of this lifting impulse permits lowering of the blade to ground level.

More recently, following the fitting of an hydraulic pump, I have replaced the winding drum lifting mechanism with an hydraulic ram, which can be made in a garage workshop. Plate 141 shows the new arrangement, and Plates 142 and 143 the new bulldozer in operation.

* Mr. Bird is a South Burnett farmer. He has furnished these notes on a bulldozer attachment of his own manufacture at the request of Mr. J. A. Kerr, a Departmental Officer stationed at Kingaroy. The drawings are by Mr. W. Manley from sketches prepared by Mr. Harry W. Miller, who is employed on Mr. Bird's property.—Editor.

Jobs Completed.

Work which I have carried out on my property with the bulldozer includes the following:—

1. Filling in gullies up to 7 feet deep and 8 feet wide in cultivation areas.
2. Levelling off high spots in the fields after filling gullies—this operation was done in three sections:—
   (*a*) Skimming surface soil to one side;
   (*b*) Levelling the subsoil;
   (*c*) Returning and spreading the surface soil.
3. Assisting the construction of broad-base contour banks, particularly in portions where the volume of surface soil has been considerably reduced by erosion.
4. Correcting faults in contour bank construction, involving moving portions of banks either up or down the slope and cleaning outlets, &c.
5. Erecting banks to divert water from cultivated fields. (Plates 142 and 143.)
6. Excavating water channels to remove excess water discharged from broad-base contour banks.

Limitations of the Outfit.

This bulldozer is not suitable for removing big timber, nor for shifting soil on hard, unploughed country. However, in addition to the uses listed above, it should be handy for many other jobs around farms.

Plate 138.
FRONT AND SIDE VIEW OF THE ORIGINAL MODEL BULLDOZER.

Plate 139.
GENERAL VIEW OF THE ORIGINAL MODEL BULLDOZER.

Plate 140.
A CLOSE VIEW OF THE WINDING DRUM LIFT OF THE ORIGINAL MODEL.

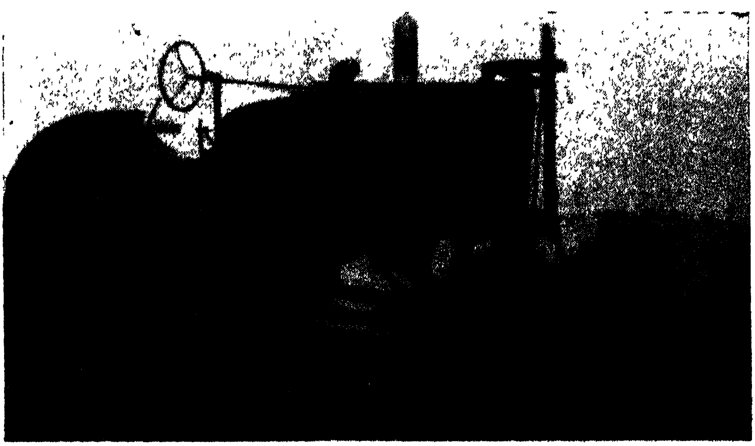


Plate 141.
SIDE VIEW OF THE IMPROVED MODEL, SHOWING THE HYDRAULIC RAM.

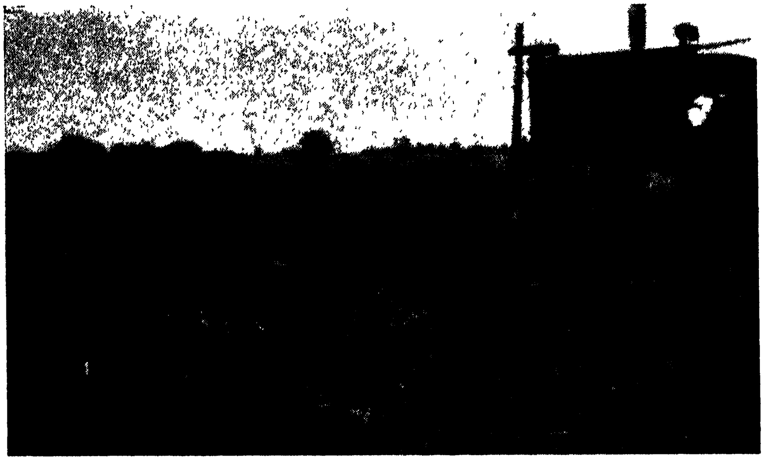


Plate 142.
THE IMPROVED MODEL BULLDOZER SHIFTING EARTH TO MAKE A CONTOUR BANK.

Plate 143.
SHOWING THE DOZER BLADE LIFTED.

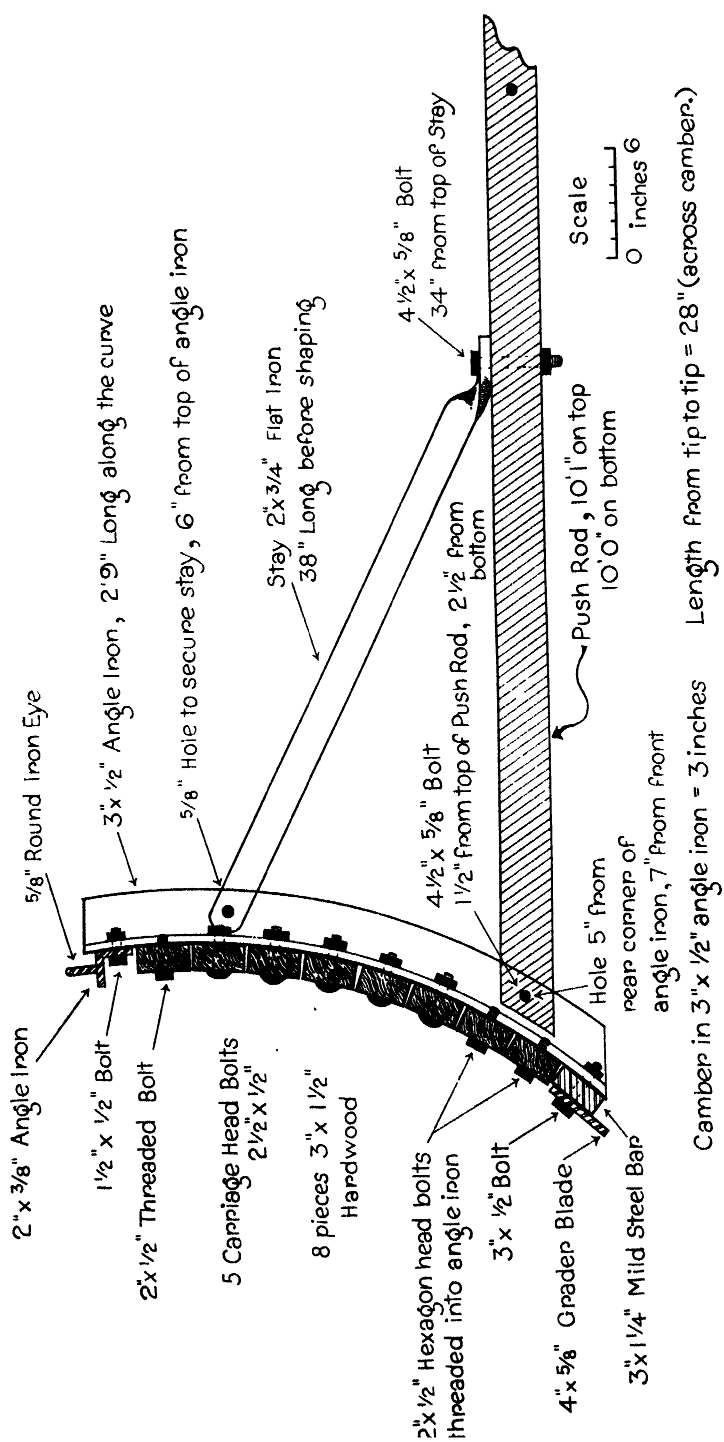


Plate 144.

SIDE ELEVATION OF THE DOZER BLADE.

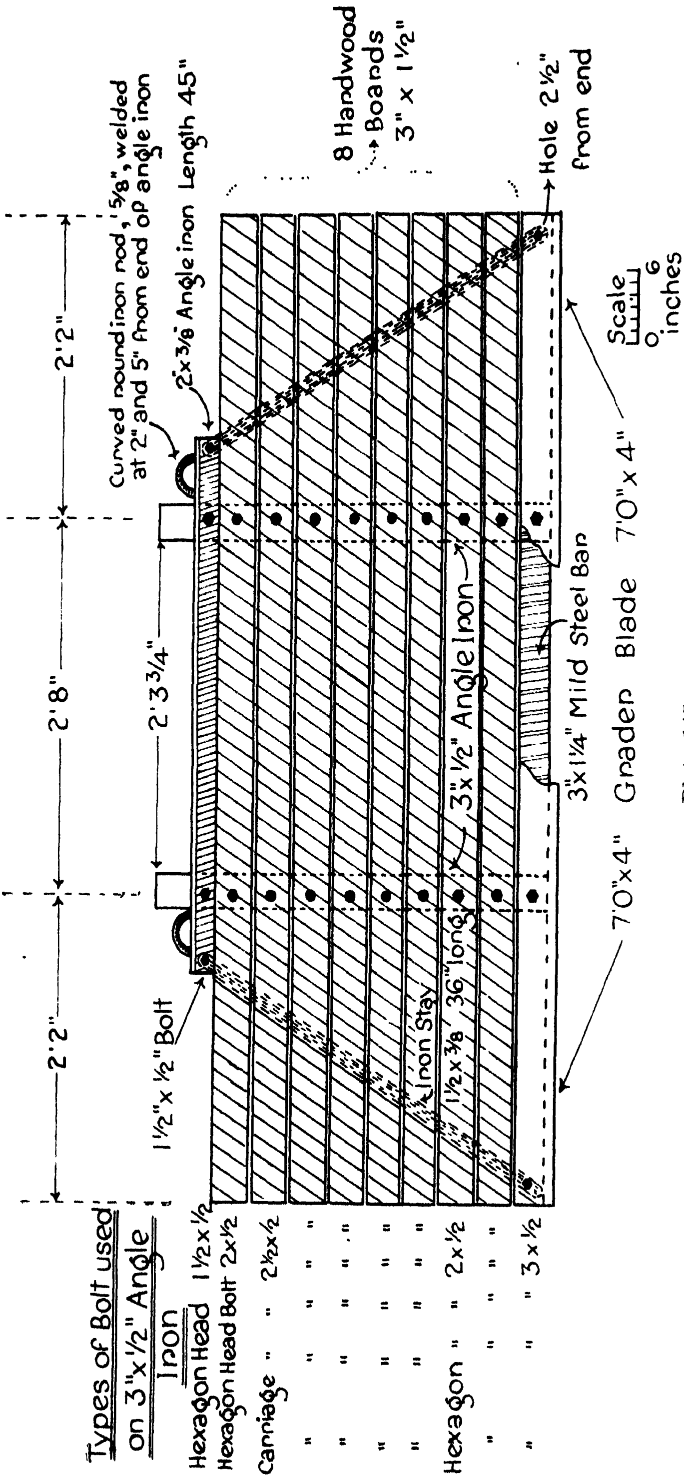


Plate 145.

Front Elevation of the Dozer Blade.

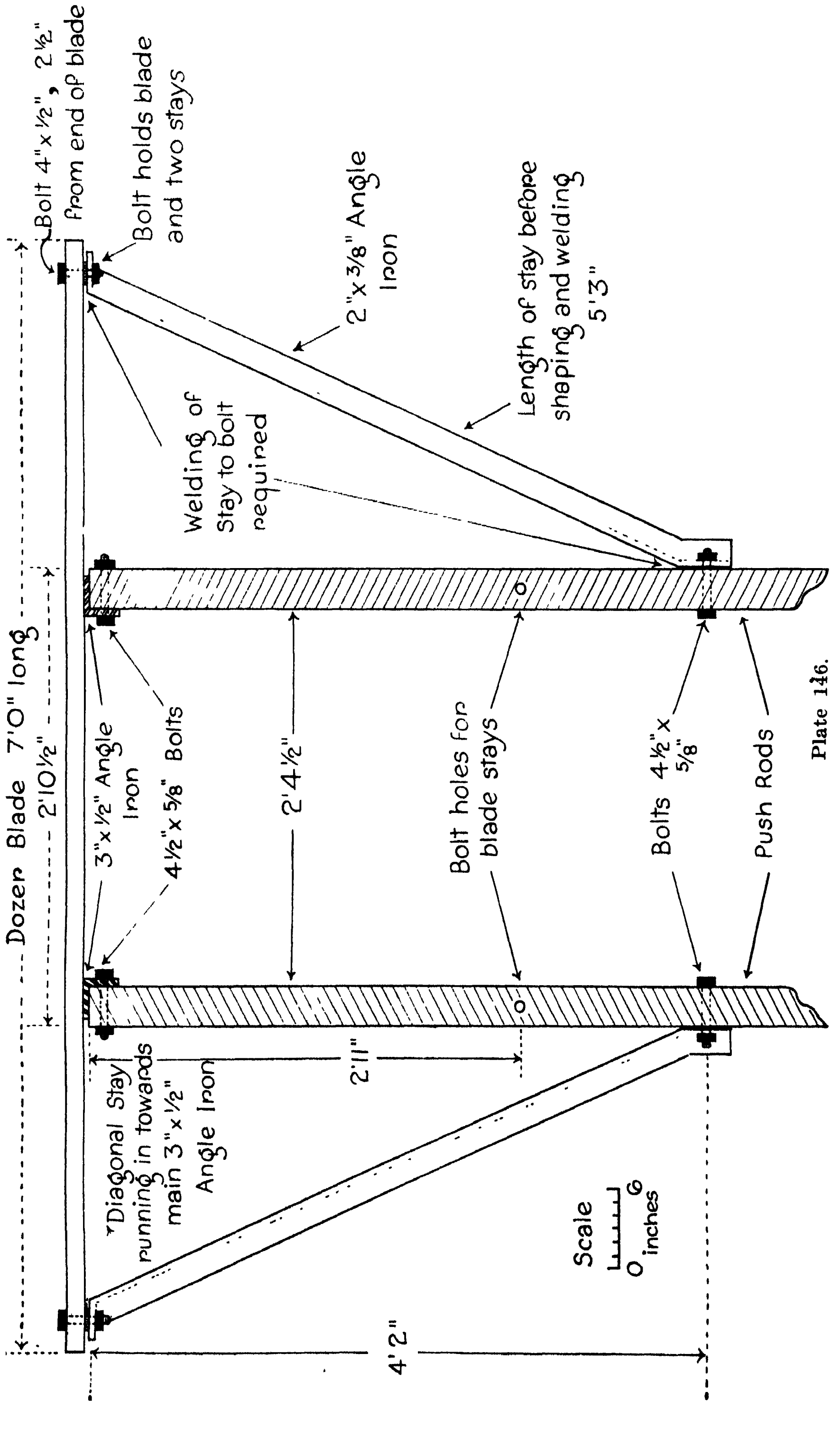


Plate 146.

DIAGRAM OF MOUNTING OF BLADE TO PUSH RODS.

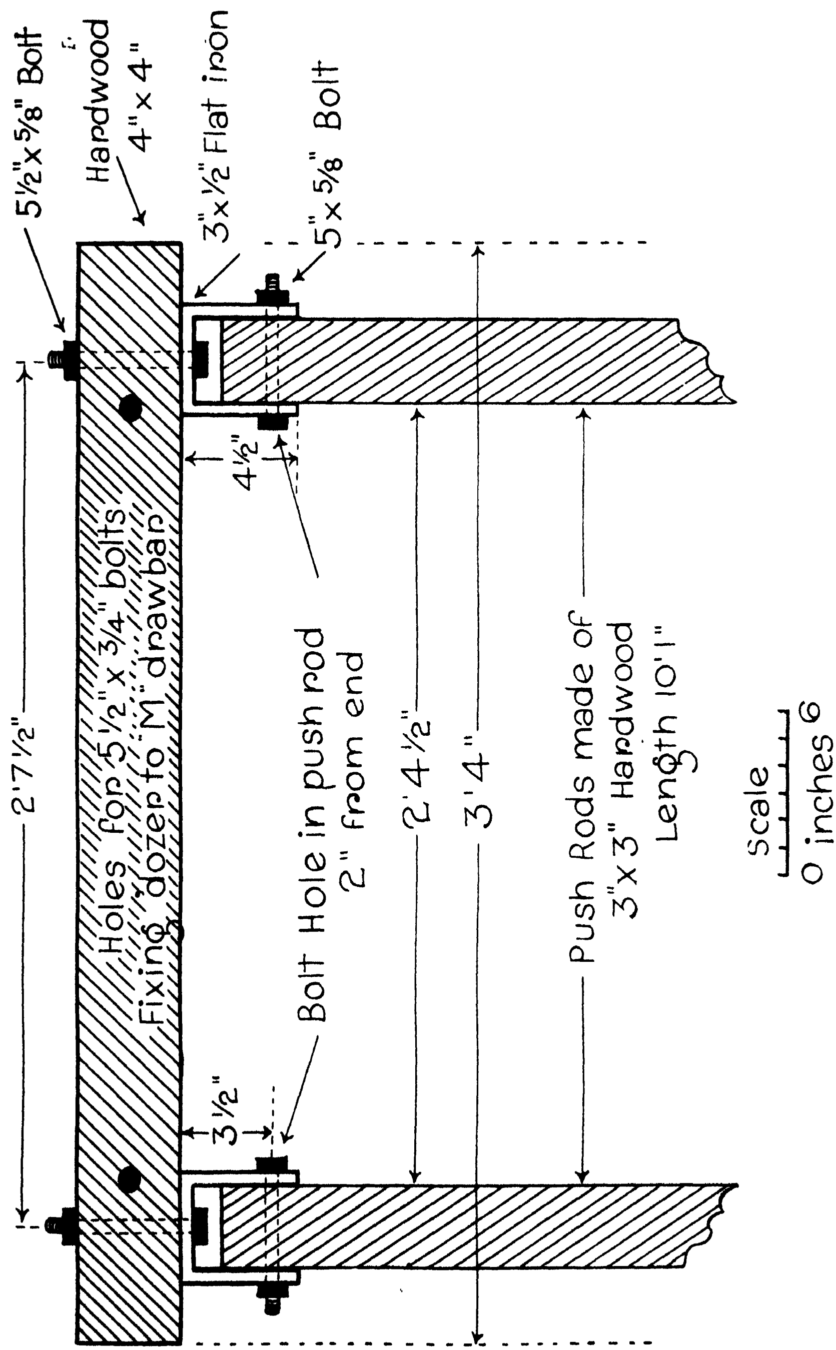


Plate 147.
DIAGRAM OF MOUNTING OF BLADE TO TRACTOR DRAWBAR.

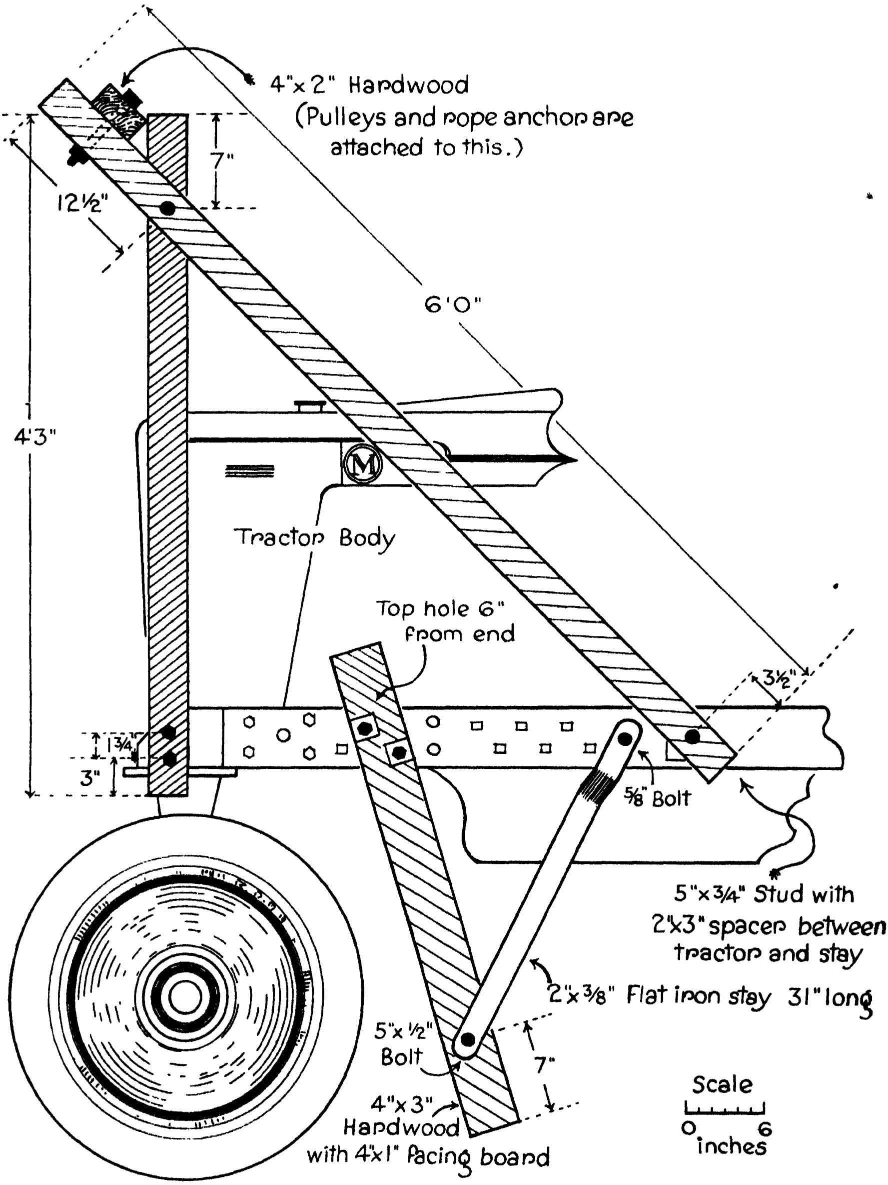


Plate 148.

DIAGRAM SHOWING DERRICK AND GUIDE ARMS FOR PUSH RODS (ORIGINAL MODEL).

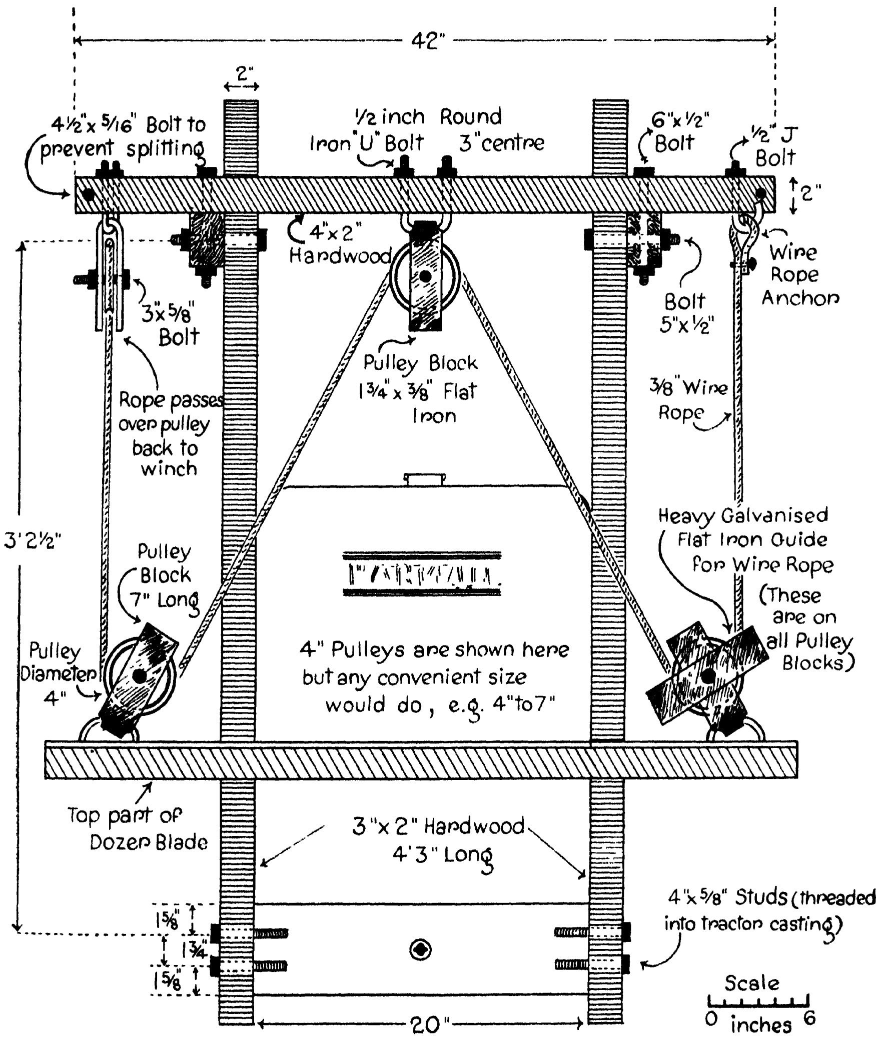


Plate 149.
DIAGRAM SHOWING DERRICK WITH PULLEYS IN POSITION (ORIGINAL MODEL).

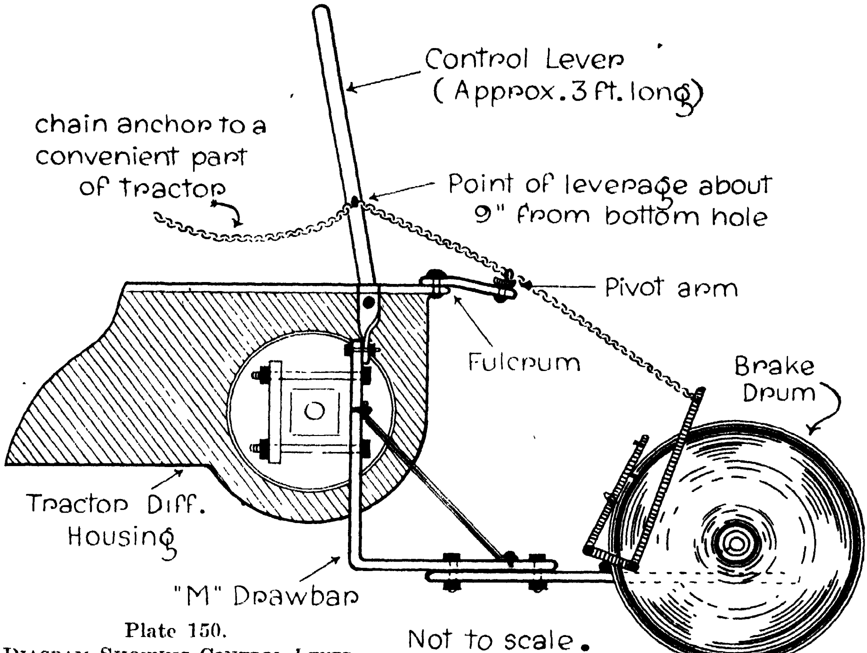


Plate 150.
DIAGRAM SHOWING CONTROL LEVER MOUNTING (ORIGINAL MODEL).

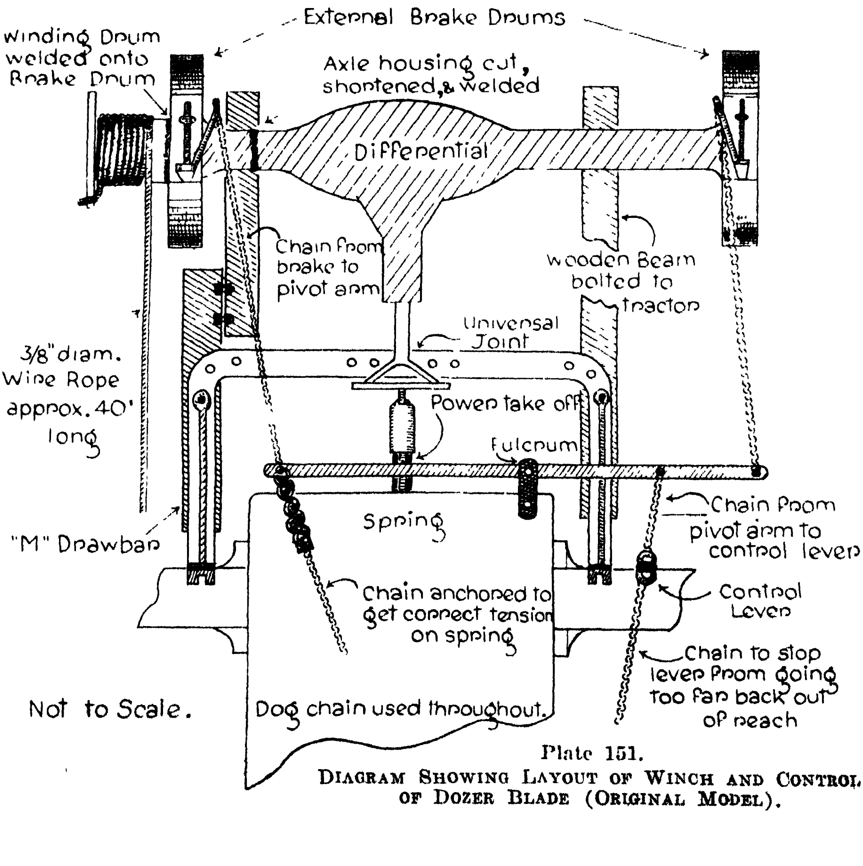


Plate 151.
DIAGRAM SHOWING LAYOUT OF WINCH AND CONTROL OF DOZER BLADE (ORIGINAL MODEL).

VEGETABLE PRODUCTION

Bean Growing in the Gympie District.

K. D. HOFFMANN.*

UNTIL 1935, bean production on a commercial scale was of minor importance in the Gympie district. A sudden drop in banana prices occurred about that time and growers were faced with the urgent necessity of finding an alternative crop for land for which high prices had been paid and which was either too steep or of insufficient acreage for dairying purposes. The demand by southern States for French beans during the winter months, and the suitability of the district for the growing of the crop at that time of the year, combined to establish beans as a vegetable crop of major importance.

In the early years of large-scale bean growing, farmers were beset with a number of problems. Production was seriously hampered by the ravages of bean fly, which made all but late autumn to spring plantings hazardous. Satisfactory control measures for this pest, which are now widely used, had not been worked out at that time. There was little information available on correct fertilizing practice, and the performance of different varieties was almost an unknown factor. However, in spite of these and other difficulties, the industry has steadily expanded and a high standard of efficiency has been attained. Record production figures were established in 1945 when the Gympie district, including Cooroy and the Mary Valley, marketed approximately 160,000 bushels.

CHOICE OF SITE.

Freedom from Frost.

The bean plant is readily damaged by frost and this fact must be borne in mind when the bean-growing area is being chosen. While a heavy frost completely destroys a crop, even a light one can do sufficient harm to cause an economic failure. Of paramount importance, therefore, is freedom of the area from the possibility of damage from what would be considered only light frosts. For this reason, all winter cultivation of beans is confined to hillsides.

Protection from Wind.

Protection, especially from westerly and southerly winds, is almost a necessity for the area under crop and is certainly a sound precaution. Boisterous winds may cause direct injury to the plants,

* Formerly Adviser in Horticulture.

such as breaking and twisting of the branches or even breaking of the bush itself. Scorching of the leaves, especially by westerly winds, stunting of growth and dropping of the flowers are also associated with exposure to strong cold winds. In addition, the drying effect of such winds on the soil may be very considerable.

The protection given to a crop by a natural timber windbreak is excellent. However, as the maximum amount of sunlight must reach the cultivation, the amount of timber left on the eastern, northern and western sides of the area should not be excessive.

Protection for small areas can be provided readily by growing windbreaks of cow cane, spaced at appropriate intervals through the crop. As a rule, the cane is planted two or three rows to a break and the distance between breaks varies from about one-and-a-half to two chains.

Aspect.

Easterly and northerly slopes are preferred for bean growing. They receive the maximum number of hours of sunlight and hence are appreciably warmer than southerly and westerly slopes. As a result, the length of time from planting to harvesting may be three or four weeks less than in the case of cold slopes. Easterly and northerly slopes also enjoy a certain degree of natural protection from cold westerly and southerly winds, whilst crops grown on them are less subject to disease, especially in wet winters.

Water Supply.

Suitable water in sufficient quantities for irrigation purposes is a major asset. Frequently, during the winter months a dry period is experienced at what might be a critical stage in the growth of the crop. Plants may be stunted, flowering spoilt, or the filling out of pods delayed by lack of an inch of rain and the result is a poor crop. A water supply capable of yielding an acre-inch each week may be considered sufficient to save the situation. This represents approximately 22,000 gallons per acre per week.

It is advisable to submit a sample of the water to the Department of Agriculture and Stock for analysis to determine its suitability for irrigation purposes before any outlay is made on irrigation plant.

Soil.

Since beans are a short-term crop, good soil conditions must be provided prior to planting. Drainage must be adequate to cope with heavy rains. Waterlogging is followed by stunting and yellowing of the plants which, in turn, is accompanied by reduced yields, and if it is prolonged the plants may die. A depth of 12 inches of well-drained soil can be considered suitable for cultivation. Loams, whether of a sandy or moderately clayey nature, combining good drainage with a capacity to hold moisture, are the best bean soils.

PREPARATION OF THE LAND.

The aims of soil preparation are the building up of humus supplies in the soil by the turning in of green crops, the establishment of a friable textured soil through which water penetrates freely and in which root growth is facilitated, and the control of weeds.

Cultivation to a depth of 8 or 10 inches provides ample room for root development of the bean plant as well as a high capacity for absorbing and retaining moisture. Two or three ploughings, or a rotary hoeing followed by ploughings, are advisable. The land should then be harrowed down, the surface being left even and free from clods. Whether the crop is to be grown in late summer, autumn or winter, early preparation of the soil is essential and this should commence at least six to eight weeks prior to planting. A longer period may be advisable where a tough fibrous cover crop has been grown.

The burning of weeds and grass each year is a short-sighted policy and is to be avoided. Poor soil conditions, both physical and chemical, are the final result. The rotary hoe or cut-away disc cultivator provides a means of handling almost any cover crop or weed growth, but these crops are often turned in by the plough. Whatever the cover crop may be, it must be incorporated in the soil in time to allow soil organisms to break it down before the beans are planted. Planting the seed before the rotting process is complete results in competition between the soil organisms and the bean plant for the available nitrogen. Such competition causes the crop plant to be starved of this essential plant food.

If lime is used it should be applied soon after turning in the cover crop. By doing so, rotting of the green manure is hastened and subsequent cultivation ensures the thorough incorporation of the lime in the soil. One ton of burnt lime per acre is considered a reasonable application for bean soils in the district.

Precautions Against Erosion.

Most of the areas producing beans during the winter months are, as stated previously, situated on hillsides and preparation for the early crops coincides with the wet season. The danger of severe erosion is therefore very great where little or no cover crop is being turned in. Bulky vegetation has a binding effect on the surface soil, reduces the danger of wash, and ensures effective water absorption.

Should the area to be planted be in the path of water running off land further up the slope, diversion drains should be provided on the uphill side of this area. Where such action is not practicable, the run-off from outside areas must be conducted via waterways, which, if not securely reinforced with rock, must be left uncultivated, or, better still, grassed. In this way, scouring is prevented and the possibility of damage to both soil and crop is minimised.

Surface drainage to check sheet erosion is easily provided by opening drains across the direction of the flow of water. Steepness of slope and texture of soil should be considered when deciding on the distance between drains, but, on the average, a chain should suffice. A fall in each drain sufficient to ensure the flow of water is all that is necessary. Cross drains must be large enough to cope with a heavy run-off, as the failure of those higher up the slope will almost inevitably cause the breakdown of the drainage system below them.

Where a considerable area of land is to be brought under cultivation, a sound practice is to plough chain-wide strips across the slope, alternating with chain-wide strips of a standing cover crop. By this method, half the area can be prepared for early crops and at no time during heavy rains is an extensive area exposed to the risk of erosion.

Cultivation on the contour is most convenient for horse-drawn implements, whether the disc or mouldboard plough be used. Wheeled tractors handle contour cultivation on moderate slopes. On steeper slopes, wheel spin on the uphill side and crabbing become problems and there is always the risk that the machine will overturn. Under these circumstances, contour cultivation with horses is preferable to cultivation down the slope with a wheeled tractor, even if the size of the area has to be appreciably reduced. Downhill cultivation of land, especially at a time coinciding with heavy rains, is a practice to be avoided. The downward movement of soil is hastened by run-off water which quickly gathers momentum in the furrows. Loss of most of the soil to the depth cultivated is usually the final result.

VARIETIES.

The dwarf French bean varieties are grown exclusively and by far the most popular of these is the Brown Beauty. For productiveness and popular demand, it has long enjoyed first place. Although by no means disease resistant, it seems less susceptible than some of the other varieties to rots affecting the pods. Staley's Surprise gives good results in warmer months. Growth at that time is vigorous and the larger bushes carry the typically long pods without allowing them to brush the ground. Later plantings suffer severely from pod rots. The various Wonder varieties give excellent results as far as cropping is concerned. Their greatest drawback is a tendency to become somewhat unattractive after transport to southern markets. Feltham's Prolific is not a satisfactory market variety because of its small pod. The St. Andrew's variety still has a few supporters among growers but it is not extensively grown.

TIME OF PLANTING.

The bean crop in coastal areas is essentially a winter one. Where there is no risk of frost, the plants will grow at any time of the year, but in the hottest months the production of a good quality article is seldom possible. In summer, too, the market is usually well supplied with beans from the highland areas where production is comparatively easy at that time of the year. Consequently, planting in the Gympie and other coastal districts commences in March, or sometimes as early as February, and is carried on through the winter until about August. The main planting months are April, May and June.

Where the lower portions of a cultivation are likely to be frosted, they should be planted early. In this way, the crop is harvested before there is any serious danger of frost. Later plantings are then made at higher, safer levels.

The crop grows and matures quickly and the period during which the pods are in the best condition for picking is short. For this reason, it is advisable to plant small areas at regular intervals about a fortnight apart; then the different areas will carry their heaviest crops at different periods, thus enabling picking to be more easily handled. In addition, the market can absorb regular moderate supplies more easily.

FERTILIZING PRACTICE.

Experimental work has shown that in many coastal soils a planting mixture for beans should contain nitrogen and phosphoric acid in the proportion of 1 to 3 or 4. Potash requirements are somewhat obscure,

but a mixture containing 2 per cent. is satisfactory under many conditions; higher percentages of potash have actually shown a tendency to depress yields. A very suitable mixture for use at planting time is thus one having an analysis of 4:15:2—that is, 4 per cent. nitrogen, 15 per cent. phosphoric acid, and 2 per cent. potash. The nitrogen is best provided in the form of sulphate of ammonia as it readily becomes available to the plants, and phosphoric acid requirements are best supplied in the form of water-soluble superphosphate.

Fertilizer placement experiments have shown that good results are obtained when the fertilizer is placed in a band about six inches wide and two inches below the seed. When planting by hand is practised a furrow is usually opened to a depth of about six inches and the fertilizer is applied in the furrow and covered with approximately two inches of soil. The covering may be done with a scuffler, if conditions permit, but on steeper areas the job is one for a chip hoe or rake.

Planting machines, with fertilizer attachment, perform the operations of laying the fertilizer and planting the seed, and satisfactory results are to be expected when these machines place the fertilizer in a band below the seed.

This initial dressing of fertilizer should consist of a 4:15:2 or some similar mixture, applied at a rate of from 6 to 10 cwt. per acre. Subsequent fertilizing takes the form of a side-dressing with sulphate of ammonia at the rate of 1 cwt. per acre. This is spread in a narrow band a few inches from the plant, preferably on the top side, usually when the plants are about a fortnight old.

For guidance in judging the quantity of mixture to apply in the furrows, the following information may be useful:—

An application of ½ lb. of fertilizer per chain gives a rate of—

165 lb. per acre when rows are 2 feet apart;

132 lb. per acre when rows are 2 feet 6 inches apart;

110 lb. per acre when rows are 3 feet apart.

LAYOUT.

The rows may be planted on contour lines or up and down hill. Contour planting is preferable and more convenient under most conditions; planting across the slope is the method most commonly used.

Under some conditions, particularly on steep slopes, the rows may be run up and down hill, largely for convenience of working. In such cases, the precautions concerning water run-off stressed earlier must be carefully observed.

ROW SPACING AND PLANTING.

Row spacing varies from two feet to two feet six inches. During the warmer months, when growth is vigorous, the wider spacing allows room to work along the rows at picking time without damaging the bushes. During the cooler weather, the two-feet spacing can be quite conveniently used.

Seeds are usually spaced about four to six inches apart; but at times, to increase protection from wind, double planting (that is, two seeds together, eight inches apart) gives satisfactory results. Mechanical

planters are, of course, normally designed to drop seeds singly. Whether planted by hand or by machine, the seed should be covered by one to two inches of soil.

The seeding rate per acre varies from 35 to 50 lb.

For hand planting, only a few drills should be opened up at a time. The seeds should be dropped without delay and then covered immediately. In this way, the soil in the furrows is not allowed to dry out to any extent and so a better germination is likely to result. However, obviously the importance of this practice is diminished where irrigation is used.

CULTIVATION.

Cultivation of the crop has, as its aims, firstly, hilling up soil to the plants; secondly, weed control; and thirdly, conservation of moisture.

Hilling-up is done to provide additional mechanical support for the plant and also to assist it to withstand bean fly attack. The larvae of this insect tunnel down the stems to ground level, where many of them complete their life cycle. The effect is to weaken the stem seriously and reduce the food supply from the roots. Hilling-up the soil around the stems induces the formation of a higher, secondary root system which partly offsets the damage, though the main control of this pest is provided by sprays.

Usually the drill in which the seed is planted is not completely filled in. When the young plant is putting out its second leaves and has attained a height of four to six inches, the first hilling is done by breaking down the remainder of the furrow. This operation is generally done with a hoe, but on level or nearly level ground scufflers may be fitted with hillers and the job done by horse power. Depending on the vigour of the bean plants, amount of weak growth and other factors, a second and even third hilling may be needed at intervals of one to two weeks.

As weed control and soil moisture conservation go hand in hand, chipping and scuffling achieve a twofold objective. Scuffling can be done during the early stages of the plant's life on gradual slopes but its use is limited to inter-row spaces. Weeds in the rows must be cut out with the hoe while any cultivation deemed necessary after the plants are well grown must also be done with this implement. On steep slopes all cultivation is, of course, done by hand.

A recent development has been the use of a three-pronged raking implement to loosen the surface soil round the plants and to destroy weeds two or three times during their life. Substantial increases in yield have been claimed for this treatment, though experimental evidence in support of this claim is lacking.

IRRIGATION.

Where water is available in sufficient quantities and the weather is dry, an application of up to three inches about five to seven days prior to planting may be used. This encourages germination of weed seeds and then a light harrowing or rotary hoeing, just before planting,

is sufficient to destroy the young weeds. Planting should follow immediately after the harrowing before the soil has dried out any further.

Plate 152.
HARVESTING FRENCH BEANS ON THE NORTH COAST.

If the first watering is given after planting, it should be made as soon as possible after the closing of the furrows. Subsequently, irrigation should be used to supplement natural rainfall as required, and in sufficient amounts to ensure rapid and uninterrupted growth of the plants. A bean crop requires one-half to one inch of water (natural or applied) each week.

At flowering time, should the weather be dry, a watering of up to two inches should be given. The production of fleshy, crisp pods is dependent on sufficient moisture being available from this time onwards.

A sound plan is to water two or three days prior to the first picking. This will finish off plant development, make the pods attractive and at the same time allow the ground to dry off to some extent before the pickers have to move about on it.

HARVESTING.

During the warmer weather, picking (Plate 152) may commence eight or nine weeks after planting; but in the winter, especially on cold slopes, up to 15 weeks may elapse before the first beans are ready.

In order to market a high quality pack, careful attention must be paid to harvesting and packing. The crop must be picked at the right stage and this can be determined largely by the size of seed. When the seed of Brown Beauty and similar varieties has attained a length of about one-quarter of an inch, the pod is considered to be of a suitable size for picking. Where picking is delayed, seed development takes place at the expense of the flesh of the pods. The result is that appearance and crispness deteriorate and the beans lose their smooth outline. These faults develop particularly rapidly if the plants lack moisture during a warm spell.

Kerosene tins are very suitable for use in harvesting. They are easy to handle as the picker advances along the row and they hold a convenient quantity of beans. The usual practice is to empty each tin of beans into a sack or other suitable container, which should always be kept in a cool, shady place. When the sack is full, or perhaps sooner, the beans should be tipped on to the packing bench and spread out in a thin layer to cool and thoroughly dry before packing.

Care must be taken to ensure that the minimum amount of damage is done to the bushes, particularly in the early pickings; otherwise the latter portion of the crop will suffer.

The first picking is not usually heavy, as only the few forward pods which are formed from the early flowers are ready. Second, third and fourth pickings account for the greater part of the crop. Market prices determine the number of further pickings but five or six at intervals of three to five days are usual.

Yields vary considerably, but an average of 100 cases (1½ bushel) per acre is grown regularly by many good bean growers, who, from some patches, would obtain much higher yields. However, an overall average for the district would probably be in the vicinity of 60 cases per acre.

PACKING.

Before packing the beans, the case should be weighed and the weight plainly marked or stencilled on the case. If the cases are made soon after receiving the timber and then stored for some days prior to packing, drying of the timber takes place and case weight decreases. For this reason it is wise to weigh just prior to packing and to mark on the case the weight to the nearest pound above the reading.

The agent's name, address, and number as well as the grower's name and address should be neatly stencilled on the ends of the case or in a prominent position on the bag, whichever is being used.

The most common method of packing in cases is to lay the beans across the case in handfuls, keeping the pack firm as height is built up. A bulge of from one to two inches allows for shrinkage in transport and still keeps the pack firm throughout. For the southern market, the one-and-a-half bushel case is used. The average weight of beans in this case is 65 lb.

Special bean bags or sugar bags holding approximately 35 to 40 lb. are used for local markets.

When packed, the cases or bags should be stacked in a cool position. Cases must be stacked on their sides; in fact, the bulge of the lids prevents any other action. Bags must be stacked only in small stacks, otherwise the lower bags are crushed by the weight.

During transport to rail the cases or bags should be sheltered from the sun and rain to ensure marketing of a high quality article.

PESTS AND DISEASES.

There are several serious pests of beans, and of these the bean fly is of outstanding importance. If efficient control measures are not applied, this one insect pest alone can markedly limit bean production as soon as warm weather commences, and in the later summer months it can completely destroy the crop. It may even cause severe losses during a mild winter. Other pests that may adversely affect the bean plant include aphids, flower caterpillars, pod borers, bean thrips, red spider, and the green vegetable bug.

The outstanding diseases of beans are halo blight, anthracnose, and "nestiness." The first two diseases mentioned are seed-borne. Consequently every effort should be made to purchase certified seed and so prevent their establishment in a planting.

Further information concerning bean pests and diseases is available in publications issued by the Science Branch of the Department of Agriculture and Stock.

USE OF GREEN CROPS.

The soil can be kept in a condition suitable for bean growing only by satisfactory soil management practices, and this involves the protection of the soil against erosion and from the heat of the sun, and the incorporation in it of considerable quantities of humus-forming materials. As a general rule, this means the growing of green crops in rotation with the beans.

A useful rotation is provided by weeds and grasses common during summer months on most bean lands. Red Natal grass, summer grass, crowsfoot grass, stinking Roger, and thistles, all contribute to making an appreciable tonnage of green matter per acre. However, they do tend to aggravate the weed position in subsequent bean plantings, and consequently the planting of one of the well-known cover-crop species should be favoured.

Poona pea gives satisfactory results. The crop provides good protection against erosion, and when sown at the rate of 50 to 60 lb. of seed per acre a good tonnage of green matter for incorporation in the soil is usually obtained. In addition, fixation of nitrogen makes the soil richer in this plant food. When sowing on the land for the

first time, inoculation of the seed with the appropriate bacterial culture is advisable. These cultures are available from the Department of Agriculture and Stock at the nominal charge of 1s. per bottle, which is sufficient to treat three bushels of seed.

Sorghum or Sudan grass is preferable where a great bulk of more fibrous material is sought. Seeding rate for these crops should be 20 to 25 lb. per acre, in the case of sorghum, and 15 lb. per acre for Sudan grass.

White panicum sown at the rate of 15 to 20 lb. per acre is another suitable rotation crop, while maize sown at a rate of 30 lb. per acre also provides a good bulk of green material which is high in fibre.

All these crops should be sown in the spring after the last beans have been picked, and it is advisable, if practicable, to turn them in before mature seed has been produced; otherwise, a volunteer crop may appear later at a time when it is not wanted.

Recent Books.

"Fream's Elements of Agriculture."

The 1949 edition of this textbook, which was prepared under the authority of the Royal Agricultural Society of England, can be recommended to farmers and students as one of the most comprehensive available.

An extremely wide range of subjects is covered in 700 closely packed pages, and while some of the matter on practical crop and animal husbandry has little or no relation to Queensland conditions, there is an immense amount of information on both principles and practices which is of value to primary producers.

"Britain Can Breed It."

A booklet bearing the above title is being distributed by "The Farmer and Stockbreeder" (England) to remind overseas stockraisers that Britain is maintaining the high quality of its stud stock.

All the important British breeds of livestock are pictured, and accompanying notes set out briefly the origin and features of each breed.

A list of breed societies in Britain is appended for the benefit of those interested in importing pedigreed animals from the British Isles.

"Artificial Insemination of Farm Animals in the Soviet Union."

The Australian firm of Angus and Robertson Ltd. has recently published a translation of a standard Russian book on the artificial insemination of livestock. The publication is well illustrated, and describes Russian methods of collecting, examining, and storing semen of various types of livestock and of inseminating females.

Selecting Avocado Varieties.

H. M. GROSZMANN, Horticulturist, Horticulture Branch.

IN California, where avocadoes are grown on a large scale, the big proportion of seedling trees and inferior varieties is a serious handicap to the industry. In Queensland, where the industry is comparatively young, the same defect is already obvious in the low returns for fruit from such trees, and it is clear that some standardisation of varieties is essential. The number of varieties must be reduced to a minimum, and they must be the best available. The longer this change is delayed, the more costly it will become, while increased confusion in the market will continue to retard expansion.

In California dozens of varieties have been studied. From the best of these, several were selected by the Queensland Department of Agriculture and Stock for observation under Queensland conditions, and it is now possible to recommend varieties for current plantings. Two varieties, Fuerte and Nabal, should constitute the bulk of all plantings in the near future, and unprofitable seedling trees should be worked over to either one or the other. In choosing the above varieties, emphasis has been placed mainly on fruit quality.

Fruit of the Fuerte variety averages about 12 ounces in weight and carries well. Flavour and texture are excellent, the seed is small and the skin fairly thin. The fruit matures approximately from May to July inclusive, the period being somewhat dependent on locality and season. The tree is low-growing and large and will withstand frosts down to about 28 deg. Fahr. There is some indication that this variety fruits better on the basaltic plateaux near the coast than on the lower coastal land of southern Queensland.

The Nabal bears a large round green fruit, which is also of excellent quality. The seed is comparatively small, and the skin is thicker than that of the Fuerte. The season of maturity lasts from about October to December. The tree is large and vigorous, though a trifle tall. It is not as frost-resistant as the Fuerte. Heavy crops have been observed on both the lower coastal slopes and the basaltic plateaux of southern Queensland.

For some time it was believed that fruit setting in avocadoes could be improved by interplanting varieties from two distinct pollination groups. This practice may not be necessary here, but growers who wish to play safe can interplant their Fuerte and Nabal groves with a small proportion, about one to eight, of a third variety, the Anaheim. Because of its intermediate period of flowering, the Anaheim is not an ideal pollinator, but it does overlap the other two in this respect, and in any case it is a prolific bearer which comes into bearing at an early age.

Avocado groves consisting of these three varieties can be expected to bear payable crops of excellent quality fruit for the Australian market.

Junior Farmer Championships.

The Australian Broadcasting Commission's competition to select this State's representative to take part in the all-Australia contest to decide the champion junior farmer leader for 1949 was held at the studios of 4QG on the evenings of 24th and 25th March.

As was expected the competition aroused considerable interest. After eight competitors chosen from the nominations received had faced the judges on the first night, Messrs. Anthony L. Saclier (Swanfels), Gordon T. Reid (Willowvale), Kenneth B. MacDougall (Gayndah) and Stephen S. Dmitrieff (Thangool) were selected for the final test on the second night. Only a few points separated the four contestants, Stephen Dmitrieff being the winner with Anthony Saclier runner-up. The other two competitors tied for third place.

Stephen Dmitrieff, who is 19 years of age, is a prominent member of the Biloela Junior Farmers' Club and leader of the club's Thangool section. He put up an excellent performance to win the Queensland section of the contest, and subsequently went to Sydney as the guest of the A.B.C. to take part in the Australian final. The winner of this contest was a New South Wales entrant.

The winner of the Queensland girls' section was Ena Carpenter, of the Helidon club, who later competed in Sydney against girl club winners from the other States.

Both Queensland representatives are keen members of their clubs and thoroughly deserved their initial test successes.

Mr. T. L. Williams (State Director of the Junior Farmer Movement) said after the contest that he hoped many more clubs would be operating next year and that a still wider range of competitors would be offering for selection.

PLANT PROTECTION

The Mite Problem at Stanthorpe.

A. W. S. MAY, Entomologist, Science Branch.

THE widespread use of DDT in orchards in the Stanthorpe district has been a potent factor in the building-up of mite populations on fruit trees during the past season. Several species of mites are usually present in orchards but are normally kept under control by their natural insect enemies. The use of DDT for fruit fly or codling moth control results in heavy mortality among the parasites and predators of mites, but the mites themselves are not affected by the insecticide.

These notes have been prepared for the purpose or warning growers of the dangers of heavy mite infestations and of suggesting measures for combatting the pests.

Mites on Stone Fruits.

Although leaf injury caused by mites did not develop to any great extent before fruit harvesting and had little effect on the season's crop, considerable damage was evident in March and this may influence tree vigour next season.

Red spider and Bryobia mite, both well-known mite pests in orchards, have been prevalent, causing leaf mottling and russetting in Wilson and other early maturing plums. A third mite, known as the Eriophyid mite, has shown a very substantial increase in the past season on both peaches and plums. This mite, which is too small to be seen with the naked eye, causes silvering and curling of peach leaves, and in extreme cases symptoms that suggest a general decline in tree condition. On plums it causes a general yellowing of the foliage, accompanied by curling and stunting of the younger growth.

Where DDT is being used for fruit fly control, a suitable spray should be employed to check mite build-up. A dormant oil will effectively reduce the overwintering mite populations, but should be supplemented by a lime sulphur or wettable sulphur spray during the summer period. Where lime sulphur is used to prevent brown rot development, mites are automatically controlled.

Mites on Apples.

Mites have been very active on apple trees, causing yellowing or russetting of foliage as well as delaying fruit colouring. When they occur on a tree in very large numbers they have an appreciable effect on tree conditions before leaf symptoms become very evident, and in extreme cases the vigour has been materially retarded, with an associated heavy leaf fall.

Where codling moth control was based on DDT, mites bred practically unchecked after the application of the first codling moth cover spray in early November, becoming very prevalent in late January. Their injury will persist until leaf fall in late autumn.

Naturally, the use of DDT cannot be drastically reduced without prejudicing codling moth control, but the substitution of lead arsenate for DDT in certain cover sprays would reduce the mite problem without detracting greatly from the value of the codling moth control schedule.

Specific treatments for mite control should be aimed at preventing mite increase in the early summer and midsummer months. Dormant or semi-dormant oil sprays, while of great value, cannot be expected to completely solve the mite problem; but an early summer application of "Hexone," white oil (1–60), or wettable sulphur, either alone or in combination with the December cover spray, should greatly assist in preventing mite damage next season. Thorough tree coverage is, however, essential.

Dipping of Winter Bananas.

J. H. SIMMONDS, Officer in Charge, Science Branch.

BANANAS forwarded to southern markets during the cooler months of the year often develop squirter and winter black end, which are manifestations of a disease caused by a fungus.* The trouble is seen only rarely in Brisbane, as the fruit is usually ripened before the disease has time to develop properly. It is not seen in the plantation and hence most growers do not realise how serious squirter can be.

In a squirter infested fruit the centre of the pulp becomes decayed and rotten and may often be expelled by a squeeze of the hand—hence the name. The external appearance remains fairly normal. Winter black end is a black decaying condition of the fruit stalk which renders the fruit very unattractive and may also rot the tip of the pulp. As squirter does not show up clearly externally, buyers are loth to purchase fruit which is likely to develop the disease later, and so prices may be severely depressed.

It has been known for several years now that dipping the fruit in a solution containing salicylanilide will kill the spores of the fungus causing the disease and so prevent its development. These spores get on to the fruit in the plantation and packing shed, and once a suitable injury is made by breaking the finger stalk the fungus, unless prevented by the fungicide, can enter and rot the fruit.

Since a simple and effective remedy exists for this disease, authorities in most of the southern States have now decided to protect banana consumers by making it compulsory to treat all fruit marketed during the cooler months with salicylanilide. Queensland growers will have to comply with these regulations and directions for treating fruit are accordingly given here.

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* *Nigrospora sphaerica.*

Method of Treatment.

The fungicide salicylanilide is usually marketed in the form of sodium salicylanilide, which is a water-soluble powder. Two proprietary lines are now being marketed. A wetting and spreading agent should be added to the fungicide, if not already incorporated, to ensure that the fungicide thoroughly covers the fruit. The rate of dilution as recommended by the manufacturers should be used; it is usually 8 to 10 ounces of the commercial product to 30 gallons of water.

The fruit should be dipped in the solution after breaking into singles and part hands and either before or after packing. Dipping in the case is quite satisfactory and is perhaps the simplest method. A suitable bath can be made from a 44-gallon drum. A draining board should be provided to save the liquid. The fruit should remain in the solution until thoroughly wetted, the mixture being agitated if necessary to ensure penetration. The solution will remain active for two or three weeks, but should be discarded when dirt and debris accumulate.

INOCULATION OF LEGUME SEEDS.

★ ★

The Department of Agriculture and Stock supplies cultures of bacteria for the inoculation of seeds of legumes such as Poona pea, blue lupins, lucerne and clovers.

Seed inoculation is often necessary where the legume intended for planting has not previously been grown successfully, as it provides the plants with bacteria which are necessary for their full development.

Cultures are available for one shilling a bottle. Each bottle is sufficient to treat up to three bushels of seed.

Order from the Under Secretary, Department of Agriculture and Stock, Brisbane, at least 10 days before sowing. State amount and type of seed to be treated and enclose payment.

Factors Affecting the Composition of Milk.

PREPARED IN THE DIVISION OF DAIRYING.

A THOROUGH knowledge of the conditions which at various times affect the composition of milk is essential to milk and cream producers. A full realization of all factors involved will give a new interest to those engaged in milking and at the same time help them to understand why milk tests fluctuate in such a puzzling manner, throughout the year.

A combination of conditions frequently affects the compositional quality of milk so seriously as to cause grave concern to both factory managers and producers alike, and at such times both the butterfat and the solids-not-fat are reduced below the minimum legal standards of 3.3 per cent. and 8.5 per cent., respectively.

The individual factors affecting the composition of milk are now fairly well known and are discussed in the following sections.

Breed.

This is the most important factor influencing the percentage of fat in milk. For instance, Jersey and Guernsey milks are usually richer than Friesian, with Australian Illawarra Shorthorn and Ayrshire intermediate between them, as shown in Table 1.

TABLE 1.

Breed.	Fat Percentage.
Holstein-Friesian	3·7
A.I.S.	4·0
Ayrshire	4·0
Guernsey	4·9
Jersey	5·3

Those breeds which produce a milk of high fat content give less milk than those which are low testers—for example, Holsteins, which are heavy producers, secrete milk of a lower fat percentage. However, the best representatives of the various breeds exhibit little difference

in the gross efficiency of milk production. Although some breeds normally produce a percentage of fat as much as 2 per cent. higher than that of others, the difference between animals of the same breed is occasionally greater.

The size of the fat globules also varies among breeds. Jerseys and Guernseys produce milk containing the largest fat globules and Ayrshires the smallest. In general, there is a slight tendency for the higher-testing cows of any particular breed to secrete milk with larger fat globules than that of the lower testing animals.

Individuality of the Cow.

This is probably the principal factor affecting the composition of milk. Possibly in every herd will be found cows that consistently produce milk abnormal in composition—for example, milk low in fat or in solids-not-fat. The variations due to individuality occur even when conditions of management, environment and feed are identical. Inheritance is the principal cause of these differences. Families of cattle within a breed have been found to secrete milk either higher or lower in fat percentage than the average for most of the same breed.

Stage of Lactation.

For five days after freshening, the secretion of the udder (colostrum) is rich in solids-not-fat, albumen and globulin being present in large quantities. Percentage fat increases during the next fortnight, and is then constant for about three months, but after this, as the quantity of milk decreases, the percentage of fat increases till the lactation period closes.

Season of the Year, Weather Conditions, and Temperature.

These are complex factors and their influence is very difficult to assess. Other factors being equal (which they never are) it would seem logical to expect small animals with relatively greater surface area per unit of liveweight to withstand high temperatures better than large animals. The colour of the animal may also be of some significance.

Efficiency of Milking.

Quick and thorough milking is found to have a marked effect on the quantity and richness of milk, sometimes as much as 30 per cent. more milk being yielded by a cow when milked by an efficient milker. Incomplete milking not only leads to a diminished yield and decrease in fat content but also contributes to the more rapid drying-off of the cow.

Interval Between Milkings.

The longer the intervals between milkings, the greater the amount of milk obtained and the lower the percentage of fat in the milk; hence night's milk is usually richer in fat than morning's milk.

Health of Cow.

The secretion of a cow in ill health is in most cases considerably reduced. No generalization on the effect of disease on the composition of milk can be made; the fat percentage may rise or fall.

Milk from sick cows is usually discarded because of its lowered palatability (principally because of an increased salt and catalase content) and for aesthetic reasons.

(*a*) *Mastitis.*—Milk from cows suffering from mastitis is often abnormal in chemical composition and may continue to be so even after the udder appears normal.

(*b*) *Colostrum.*—For five days after calving, the milk of the cow is of abnormal chemical composition and is known as colostrum. Colostrum is reddish-yellow in colour, and has a strong odour and a bitter taste. It is higher in albumen, casein, globulin and ash and lower in lactose than is normal milk. Colostrum, while being ideal nourishment for the calf, is unfit for human consumption. A comparison of the approximate composition of colostrum with that of milk (Table 2) shows its essential difference.

TABLE 2.

	Colostrum. Per cent.	Milk after 7 Days. Per cent.
Fat	3.4	3.9
Sugar	2.5	5.1
Casein	4·8	2·5
Albumen and Globulin	15.8	0.7
Ash	1.8	0.7
Water	71.7	87.1

Age of Cow.

Many investigations have been directed towards showing the effect of advancing age upon milk production. A considerable amount of variation has been observed, but the variations in fat percentage with age have been found to be unimportant from a practical point of view.

Kind and Quality of Feed.

These exercise a most important influence on the quantity of milk secreted, but as far as is known have no permanent influence on fat content. After a prolonged drought period the percentage of solids-not-fat, particularly casein, may be lower than normal owing to the lack of proteins in the foodstuff and the exhaustion of body reserves. In districts in which the soils are deficient in calcium and phosphorus, the herbage may also be deficient in these elements and the cow draws on these two elements from her own bones to prevent a deficiency in the milk.

Exercise.

Experiments have shown that exercise tends to cause the percentage of fat in milk to increase slightly. Exercise also aids in the digestion of food.

Excitement and Oestrum.

The cow being a nervous animal, the fat content in milk may be affected by any condition which causes undue excitement or nervousness. Sexual excitement, oestrum or "heat" induces varying effects depending upon the individuality of the animal. With some cows there is no appreciable change in the composition of the milk, while in other cases the composition of the milk is slightly affected.

Other Factors.

These include frequency of milking, methods of milking and condition of the animal.

Losses in the Pig Industry.

F. BOSTOCK, Officer in Charge, Pig Branch.

CONSIDERABLE losses are caused to the pig industry each year by the death of pigs and the condemnation of carcasses; such losses could be reduced if greater attention were given to housing, management and feeding.

Housing.

Dilapidated, unhygienic sheds, broken troughs and filthy condition of surroundings, often deep in mud, etc., contribute largely toward lowering resistance of the pig to disease-producing germs. Under such conditions pigs are likely to develop digestive troubles, pneumonia, arthritis or other troubles which often result in high mortality or condemnation of carcasses, and the pigs that do survive prove unprofitable.

Any expenditure involved in building suitable housing will be amply repaid by the production of healthy stock, decrease in labour costs and improvement in management. The cost of accommodation should be calculated on a per head basis of each pig likely to be produced in the piggery. Such costs will usually be found to be low and it is more often than not false economy to save a few pounds in the initial outlay, when such a saving may mean slower growth, greater labour costs and greater risk of disease.

Piggeries do not have to be elaborate, but should be airy and large enough to prevent overcrowding, yet free from draughts. They should allow plenty of sunlight to enter and be provided with good drainage. The site should be such that enough well-drained land is available for runs and, if possible, paddocks for cultivation to produce supplementary food.

Purchased pigs may easily be the cause of outbreaks of disease and a quarantine pen should accordingly be provided. Such pigs may be diseased when purchased or may suffer digestive disorder, lowering their resistance, as a result of the change of food; in such circumstances the disease germs present greatly increase and become capable of causing mortality. The whole herd may suffer, because even if the death rate is not high affected pigs become unthrifty, thus reducing the margin of profit.

Feeding.

To keep pigs in good condition and gaining weight, the ration must be properly balanced and fed at regular intervals. In the case of brood sows, proper feeding is most important if strong litters of healthy pigs are to be produced.

Too often sows are turned out to forage for themselves immediately after their litter has been weaned, and expected to exist as best they can until they again farrow. This is a very short-sighted policy, as the care of the sow during gestation will considerably help to secure a vigorous litter which, with reasonable attention, can be expected to reach maturity with a minimum of loss.

Considerable strain is put on the resources of a sow during pregnancy and lactation, and if there is any possibility of the rations being deficient in calcium a mineral supplement should be fed. Such a deficiency is likely to occur when the supply of milk is limited or green feed poor, and suckers born under these conditions are likely to be stunted and unthrifty.

Care should be taken to see that any change of ration before or after farrowing does not cause digestive disorders or a check in the milk flow. To eliminate any tendency to constipation, a small quantity of molasses may be added to the ration.

Management of Sows.

F. BOSTOCK, Officer in Charge, Pig Branch.

FROM observations both in this country and overseas it is known that—

(1) A considerable proportion of sows fail to get in pig immediately after weaning a litter.

(2) Where conception takes place about one-third of the ova shed do not give rise to full-time offspring. The cause of the failure of some ova to be fertilized, or if fertilized to complete foetal development, is obscure, but it is known that the condition and health of the boar at the time of service and the feeding of the in-pig sow play a considerable part.

(3) Nearly 5 per cent. of all pigs born are born dead.

(4) A further 15 per cent. die before weaning, generally in the first two or three days.

(5) In general the more pigs born in a litter the greater the number weaned.

(6) In large litters the average birth weight is usually low, and small, poorly developed pigs are likely to be born dead, to perish early after birth, or to be slow growers if they do survive.

Sows when fed so that they do not become too poor at weaning time, and are rapidly improving in condition when they take the boar

and for a few weeks after mating, are more likely to breed regularly than are sows which are allowed to become poor or are merely turned out in the grazing paddock, without any extra feeding, after weaning a litter.

Low number of pigs reared per sow and failure to get two litters per year can be very largely overcome if more attention is given to the above facts.

Feeding during the last six weeks of pregnancy is most important to ensure well developed pigs at birth. The ration should be rich in protein, in order to nourish the rapidly developing litter and provide sufficient to enable the sow to improve in condition without becoming over-fat. These general principles of feeding the pregnant sow, if properly applied, should result in fewer stillborns, stronger pigs born (which are less likely to die in the first few days of life) and rapidly growing young stock.

Losses at and shortly after farrowing to a large extent depend on the selection of breeding stock and temperament of the sow, for the mothering instinct well developed will always be of great importance. Do not keep a clumsy sow.

See that the boar is kept in good working conditions, without sudden variations of food or alternating periods of starvation and over-feeding. Keep the boar in a pen by himself and turn sows in for mating on the second or third day of heat.

QUEENSLAND SHOW DATES.

Atherton	July 25-27
Ayr	July 8-9
Beenleigh	September 16-17
Blackbutt	June 3-4
Boonah	June 3-4
Bowen	July 6-7
Brisbane R.N.A.	August 6-13
Bundaberg	June 9-11
Cairns	July 19-21
Canungra	September 10
Charters Towers	July 5-6
Childers	June 6-7
Cooroy	August 27
Crow's Nest	May 27-28
Dirranbandi	May 27-28
Esk	July 1-2
Gatton	July 21-23
Gin Gin	June 13-14
Gladstone	June 16-18
Gympie	May 26-28
Home Hill	July 1-2
Ingham	July 15-16
Innisfail	July 29-30
Kalbar	May 28
Kandanga	Sept. 2-3
Kilcoy	June 24-25
Kilkivan	June 10-11
Laidley	July 8-9
Lawnton	July 29-30
Lowood	June 10-13
Mackay	June 28-30
Maryborough	June 2-4
Millaa Millaa	September 23-24
Mount Morgan Show	June 2-3
Mt. Morgan Camp Draft	June 4
Nambour	July 7-9
Pomona	September 9-10
Proserpine	July 1-2
Redlands	July 15-16
Rockhampton	June 22-25
Rosewood	July 15-16
Southport	September 2-3
Toogoolawah	June 17-18
Townsville	July 12-14
Tully	July 22-23
Woodford	July 15-16
Wowan	May 26-28

Poultry Keeping on the General Farm.

P. RUMBALL, Officer in Charge, Poultry Branch.

(*Continued from page 247 of the April issue.*)

FEEDING FOR EGG PRODUCTION.

The laying fowl has to provide from her food supply for—

(1) Maintenance of vital functions;

(2) Growth requirements; and

(3) The production of eggs.

The first call upon the food supply is obviously for the vital functions, then growth: any surplus nutrients are used in the formation of eggs. It will, therefore, be seen that the greater the production the greater will be the consumption, and that egg production is only possible by feeding quantities of food in excess of body requirements. It is generally estimated that a hen in full lay will consume about 2 ounces each of grain and mash per day. This quantity, however, will be excessive at times, and may be deficient during the period of peak production.

Most available cereal foods are generally deficient in protein, and in preparing a ration it is necessary to use protein-rich foods in the form of milk, milk powders, and meatmeal. Protein-rich vegetable foods may be available, but it has been found from experience that animal proteins give better results than vegetable proteins. This is probably because of their greater palatability and the fact that the range of amino-acids is wider. From practice, it has been found that rations having a total protein content of 15 per cent. give satisfactory results. As protein-rich foods are the most costly, it will readily be understood that the object of the feeder should be to use the minimum quantity necessary for maximum production.

The poultry raiser who does not desire to prepare his own ration may buy laying mashes to be fed in combination with grain, also all-mash. These laying mashes should have approximately 18 to 20 per cent. of crude protein; when fed in combination with grain—say, equal parts of maize and wheat—the total crude protein content of the ration is reduced to about 15·5 per cent.

In addition to the protein and carbohydrate, the mineral content of the layer's ration has also to be taken into consideration. The average amount of carbonate of the egg shell is one-fifth of an ounce.

To supply the requirements, say, in the mash, 4 per cent. of calcium carbonate would be necessary, but as hens not laying would only void the material it is a better practice to have shell-forming material in the form of limestone and shell grit always before the birds in separate containers.

Commercially, yolk colour has not apparently been given much consideration, but very pale-yolked eggs are not in popular demand. To overcome this, green feed and yellow maize should form a definite part of a laying ration. Both foods are rich in vitamins, and green feed materially assists in supplying the mineral requirements of poultry. In the absence of green feed, lucerne chaff or meal should be made available.

REPLACEMENT OF FLOCKS.

As previously mentioned, very few hens are retained for egg production longer than two years. This fact, together with the constant culling practised on a well-conducted farm and normal mortality, necessitates the replacement of approximately 60 per cent. of the flock each year.

It is of little use replacing old and culled hens if such replacement is not made with better producers.

Flock replacement may be made by selecting and mating the best of the birds, by the purchase of eggs for hatching, or by buying day-old chickens.

Success in poultry raising requires a close association with the birds in order to obtain records of production, and the necessary ability to select satisfactory breeding stock. This close association is usually impracticable on the average farm, so the purchase of day-old chickens is ordinarily the soundest practice.

Expansion in the poultry industry has brought with it modern equipment that permits of day-old chickens being hatched by the specialist breeder at a cost lower than that at which the small flock owner could produce his own. Incubators of 16,000 egg capacity are in operation in Queensland. These machines work at full pressure for at least three months of the year. Commercial hatcheries thus make it possible for the farmer to replace his flock with chickens hatched during the most suitable period of the year. They relieve him of the necessity of selection, mating, and incubation on his own farm, and if the chickens are obtained from a reputable source, his maintenance of a profitable flock is assured.

INCUBATION.

Although incubation can be successfully conducted throughout the year, the most profitable period in which to hatch chickens is from June to September. Chickens hatched later do not thrive and are more susceptible to disease.

Eggs should be carefully selected for incubation purposes for size, shape, and texture of shell. It is important that only eggs which exceed 2 ounces in weight be incubated in order to maintain a good commercial product. Misshapen eggs should be rejected. Eggs having porous or thin shells allow the contents to evaporate, resulting in poor hatches. If eggs for incubation are to be kept longer than one week, they should be turned daily; by this process, they can be kept for two weeks. Fertile eggs should be stored in a cool place free from draughts.

Natural Incubation.

With natural incubation difficulty is always experienced in having hens broody at the right time. When setting a broody hen, the nest should be made comfortable and darkened. The bird should be dusted with insect powder before the eggs are placed under her and again before hatching occurs. After setting the hen should not be disturbed for 36 hours. She should then be allowed to come off daily for food, water, and a dust bath. The hen should be fed on whole grain.

Artificial Incubation.

Instructions are supplied with incubators, and should be followed by the operator.

Housing.

An incubator should be housed in a well ventilated room with an even temperature. Underneath a dwelling on high blocks is an excellent place for an incubator. The incubator should be level and firmly based.

Management (Table top incubator).

The incubator should be washed and disinfected after each hatch. The lamp should be filled and the wick and burner trimmed daily; an old toothbrush may be used to clean the wick.

The incubator should be heated for at least a day before putting in the eggs, so as to be ready for regulating the temperature evenly at 102 degrees, with the bulb of the thermometer level with the top of the eggs. The eggs should be set in the morning. The thermometer should be tested for accuracy at the start of the season.

After having been set, the eggs should be left alone for 36 hours, after which they should be turned twice daily to the 18th day. The eggs should be cooled every day, commencing with 5 minutes the first week and extending the period to 10 and 20 minutes during the second and third weeks respectively. It will be necessary to remove infertile eggs during the hatch. This should be done on the 7th and 18th days.

The greater the ventilation the more moisture is required. If there is very little ventilation in the incubator, the machine may be successfully operated without moisture.

BROODING.

The artificial brooding of chickens is a difficult process with an inefficient plant. The object of the breeder is to keep the chickens warm and comfortable and to wean them from heat as quickly as possible.

Two systems of brooding are in common use in Queensland, namely, what are known as cold brooders and heated brooders. In both systems many types of brooders are used.

Cold Brooders.

The term cold brooding is a misnomer. Artificial heat is not supplied, but the heat of the body of the chicken is retained by means of cloths or flannel and a restricted circulation of air. This system of brooding has been practised for many years, but it is only in comparatively recent years that it has been used to any great extent by

commercial poultry farmers. The cold brooder can be used in brooder houses or rearing pens with an equal degree of success. Although the cold brooder may be apparently as effective as the heated brooder, the latter is preferable. It is easily understood that the placing of chickens, after travelling for a day or so, under a cold brooder warmed by their own body heat would not be as beneficial as placing them under a heated brooder. Also, in cold bleak weather the heated brooder would have an advantage over the cold brooder.

Heated Brooders.

There are many types of heated brooders, of both the box and the colony type. The former type is not used to any extent in this State. This may be because of the cost of installation of a suitable type, or the generally satisfactory results derived from the colony system.

Colony Brooder.

Where large numbers of chickens are to be reared, the colony brooder is the cheapest and most effective. With the colony brooder, several hundreds of chickens can be run together with little more trouble and attention than would be required for a hundred under any other ordinary brooding system. This system also permits of a very much freer movement of chickens once they know the source of warmth, and assists in their retention of that keenness in life which is essential to health and growth.

Four hundred chickens should, however, be the limit in any one colony brooder, but possibly 100 fewer would give better results. It is also generally a sound rule to depreciate the capacity claimed for brooders by most manufacturers.

The colony brooder consists of a heater with a metal hover for the purpose of deflecting the heat. The fuel used may be coke, sawdust, kerosene, or electricity. Whatever type of colony brooder is used, it should be housed in a special brooder house. It is possible to operate brooders in open-fronted houses by cutting off ground draughts, but obviously when such is the case considerably more fuel is used. With kerosene and electricity-heated brooders the increase in the costs of heating in open-fronted houses would be considerable. With sawdust and coke brooders costs are not excessive, but the great disadvantage of open-fronted houses is keeping up a uniform temperature. It is found in practice that they will burn out within 12 hours, with consequent chilling of the chickens.

A suitable-sized building to house a 400 colony brooder would measure approximately 14 feet by 16 feet and at least 6 feet high. The roof may be either a hip-roof or a skillion. The building should be lined and ceiled and provided with ample light. It should face north-east or north and be arranged so that sunlight can be freely admitted. Lighting through glass is desirable in bad weather, but direct sunlight is necessary to admit of the ultra-violet rays. Otherwise, cod liver oil is an essential addition to all chicken-mashes in order to supply vitamin D. A few weeks of brooding without sunlight or cod liver oil would soon result in leg-weak chickens. Sunlight is the cheaper.

The house may be built of timber or iron. Iron, being more lasting and offering less harbourage for vermin, is preferable. The

lining and ceiling should, for preference, be of ⅝-inch tongued and grooved pine, but for economy wheat sacks sewn together and white-washed will serve. The floor should be concreted and a thin concrete wall sunk into the ground to a depth of 18 inches. This wall prevents rats burrowing under the floor, while the concrete floor is easily cleaned.

Temperatures.

In heated brooders, temperature is very important. If the temperature is too low, the chickens crowd together. Correct heating is the only method by which this can be prevented. Overheating should also be avoided because of its weakening effect and the consequent difficulty in weaning from the brooders. The general comfort of the chickens is a sure index that the temperature is fairly satisfactory, and if the droppings are well distributed under and around the hover in the morning, it is proof that the chickens have been fairly comfortable. When chickens are first put into the brooder they come from a nursery in the incubator which generally has a temperature of at least 90 degrees, and so it is as well to start brooders at this temperature, gradually reducing it until heating can be dispensed with in from 4 to 6 weeks.

Ventilation.

With some types of brooders, many chickens are lost through lack of ventilation and over-crowding. Brooders usually made to hold 100 day-old chickens are generally too small for the same number of chickens a week old. It frequently happens also that the attendant makes no allowance for additional ventilation with the growth of the chickens, and, although he may have been successful in rearing them to the age of one week, they then start crowding and dying. Lack of ventilation has a great weakening effect on both young and old stock. It causes the young to crowd, and renders the older birds more susceptible to disease. When chickens have crowded, they present a wet appearance in the morning, to which the term "sweating" is applied. Sweating is not the cause. The wetness is caused by the condensation of the moisture content of the breath which would have been carried away if proper ventilation had been provided. Chickens which have been overcrowded rarely recover from the ill-effects, and so it should be avoided strictly.

In brooding under any system the following points are essential:—

(1) Limited range, increasing with age.

(2) Sufficient heat, which should be reduced as soon as advisable.

(3) Ventilation, which should increase with age.

(4) Ample accommodation. What may be just enough room for 100 day-old chickens rapidly becomes too small as they grow.

(5) Never attempt to brood chickens of mixed ages.

Placing Chickens in Brooders.

Before chickens are placed in brooders the floors should have a light dressing of sand or soil to absorb any excreta and to give the chickens a good footing. A small amount of litter, such as soft straw or chips, will provide exercise and so keep the chickens active.

With both hot and cold brooders, the liberty of the chickens should be restrained for a start. This can be done by erecting a barrier of

wire netting around the brooder (Plate 153), increasing the area day by day. At the end of about one week, they may be given the liberty of the brooder house. With the cold brooder, the netting should only allow a range of two or three inches for the first day. With the colony brooder, the range will depend on the heat given off by the brooder.

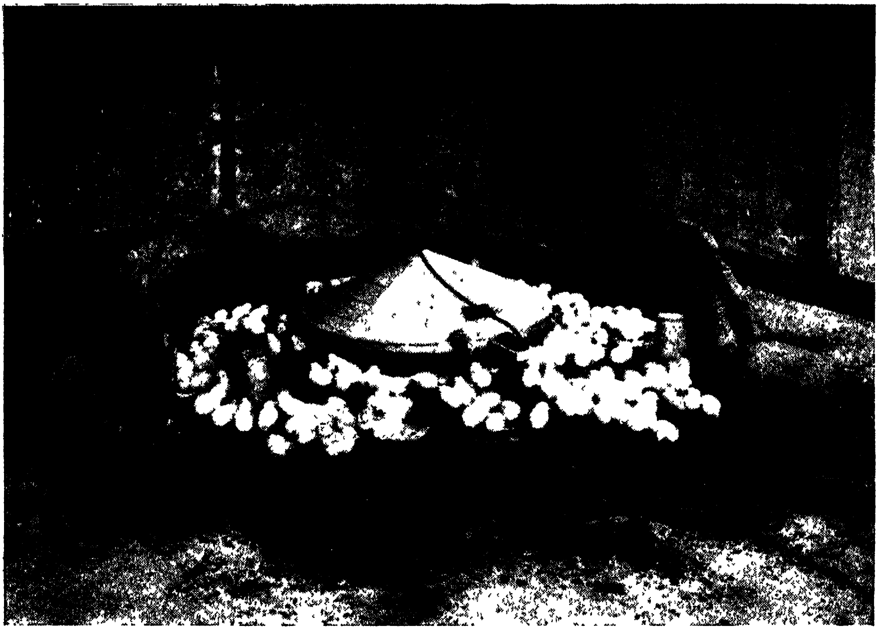


Plate 153.

ELECTRICALLY HEATED COLONY BROODER.—When chickens are first placed under the brooder they should be confined to within one foot of the outside edge and their range increased from day to day.

What is necessary is to educate the chickens as to the source of heat, and when this is done to encourage them to take as much exercise as possible by ranging over the floor of the entire brooder house (Plate 154).

Most breeders have outside runs to their brooder houses and the chickens are allowed out in them after they are about a week old. Outside runs are not necessary if the brooder house is so constructed as to permit of an abundance of light and sunshine. However, when runs are provided the chickens should be driven in after they have been out for an hour or so on the first occasion. They may be allowed out again in the course of an hour or so. This should be repeated in order that the chickens will learn to return to the brooder house and avoid to a large extent the possibility of their being caught out in a rain storm or staying out too long and becoming chilled.

Sanitation.

Cleanliness is essential. Insanitary conditions not only pollute the atmosphere of the brooders, but are frequently the cause of the rapid spread of serious diseases in very young chickens, in whom bacillary white diarrhoea is responsible at times for heavy mortality. The

chickens are very susceptible to this disease within the first 10 days. The organism responsible is voided in the excreta; consequently a few diseased chickens might easily be responsible for the spread of the disease among the whole brood. This fact emphasises the advisability of destroying sick chickens and the regular and frequent cleaning of brooders.

Plate 154.
COLONY BROODING.—Week-old chickens, with full range of the brooder house.

Coccidiosis, another disease to which chickens are subject, is spread through the medium of the droppings. With bacillary white diarrhoea, some affected chickens are the result of affected parents and when hatched are already diseased. With coccidiosis, the chicken contracts the disease after hatching. Many full-grown birds are affected with coccidiosis. The organism may therefore easily be carried on the feet of the person attending them to the brooders. Strict sanitation and precautionary measures give reasonable assurance of protection against the disorder. Brooder houses should be cleaned out every second day and the sleeping quarters daily.

WEANING.

When chickens are from 4 to 6 weeks old, it is generally necessary to remove them from the brooders to make room for others. This is also necessary to protect the soil from becoming too foul and the chickens too soft by prolonged supply of heat. Correct brooding will materially assist the weaning process, as the heat should have been gradually reduced.

The chickens were trained in the early stages of brooding and training again is essential. Poultry are largely creatures of habit and

may generally, with care, be trained to act as required. When once they form a habit—good or bad—it is difficult to alter. A little time spent in seeing that chickens take to their new quarters during the first few nights will amply repay the poultry keeper and prevent losses which occur when growing chickens crowd into corners.

Chickens may be placed in permanent laying quarters or colony houses when they are weaned. The permanent house may be an intensive laying shed or a special colony house. The colony house is an excellent system, provided it is situated on clean land and that the colony is not contaminated with the droppings of older or diseased birds.

The number to be put out together varies, of course, with the accommodation available, but larger flocks than 100 are not recommended; 50 would be safer.

A good rearing house for 100 chickens should be at least 10 feet long and 8 feet deep—with, of course, free range. The house should be 5 feet high at the back and 6 feet high in front. Ventilation should be provided by leaving a space of three inches between the top of the back wall and the roof. As a protection from south-easterly weather, at least 4 feet of the eastern front should be covered with iron. The rest of the front should be netted and provided with a gate in order that the birds can be shut in overnight as a protection from foxes and other marauders.

GENERAL MANAGEMENT.

When the chickens are taken from the brooder quarters and placed in houses to be weaned, they are too young to perch of their own free will. Various arrangements have to made to prevent crowding.

Plate 155.

WEANING PERCHES.—Chickens upon leaving the brooder house must be taught to perch. Netting frames with a ramp make this job comparatively easy.

Some breeders bed them down on straw. The straw, if used, should be fairly deep and loose and well heaped up in the corners of the house. The chickens appear to be content to snuggle in the straw instead of making warmth by crowding together. It is then only necessary to go around in the evening with a fork and loosen the straw up. In the shaking the droppings fall on the floor and are easily cleaned up. With this system of weaning, perches should be erected later and the birds allowed to take them at will.

Another system of weaning, and one that teaches the bird to perch at the same time, requires a wire-netting platform about 6 inches from the ground with a netting run-up (Plate 155). On the top of this frame several strips of 2 x 1 timber are attached. The chickens at night are not allowed to rest anywhere but upon this platform. They certainly crowd together for a start, but soon spread out. The netting allows for circulation of air. It is necessary to watch the chickens for the first few nights, but as soon as they have settled down they may be left. This platform should be made the full width of the house and placed at the closed end.

The chickens as they develop should be thinned out. No hard and fast rule can be laid down as to when thinning out should be done, as it depends on the space available.

THE FEEDING OF CHICKENS.

In the feeding of chickens, it is most important to bear in mind that nature has provided for the first day or so of the chicken's life, as, just before hatching, the remainder of the egg yolk is drawn into the abdomen of the chick. Most breeders allow at least 48 hours to elapse before feeding. Chickens fed earlier are subject to bowel troubles. Prolonged starving, however, should not be practised, as it may have a weakening effect from which many chickens do not recover.

Requirements for Growth.

Chickens make very quick growth in the early part of their life. This development is most rapid during the first six to eight weeks; consequently rations having a relatively high protein content are necessary to give the best development. From experimentation, it has been established that rations having a crude protein content of 20 per cent. should be used during the first six to eight weeks, after which the protein should be reduced to 15 per cent. The protein requirements of a chicken may not alter so sharply, but these periods of protein content are suggested as applicable to the practical needs of the poultry raiser.

It is a common practice among poultrymen to cut down the protein content of rations after the chickens are about 16 weeks of age, in order to delay sexual development. This is desirable if the birds are maturing too rapidly, but development can be controlled to only a very limited degree. Excessive protein feeding should be guarded against, as it is likely to cause deposits of urates in the ureter, kidneys, and other organs, as well as placing an undue strain on the liver.

It is generally conceded that milk is the most desirable protein feed for chickens and growing stock, but because of its cost its exclusive use may not be possible. Wherever practicable, milk should form a portion of the ration. It may be given in the form of curds, semi-solid milk.

buttermilk, or buttermilk powder. Milk is excellent as a drink, but it is objectionable because of the difficulty of keeping chickens clean. Buttermilk powder is suitable, because of the ease with which the powder may be incorporated in the mash, thereby controlling the kind of food that each chicken consumes. It has, however, no definite advantage from a feeding-value point of view, apart from its concentration. Proteins build up the flesh, but at the same time a bony framework is necessary. Analysis of the chicken at different ages indicates that it is particularly important to allow for the mineral requirement from the 11th to the 24th week. In all experiments conducted by the Department of Agriculture and Stock, the increased mineral intake has been allowed for by the addition of bonemeal to the mash at eight weeks of age and by allowing the birds free access to grit (shell and hard).

Food Consumption of Chickens.

The question is often asked: How much food should be given to chickens? Probably, no better reply can be given than to publish a table based on actual experiments conducted at the Animal Health Station at Yeerongpilly.

FOOD CONSUMPTION AND WEIGHT OF CHICKENS.

Age	Leghorns.		Australorp	
	Weight of Chickens.	Food Consumed.	Weight of Chickens.	Food Consumed
	Oz.	Oz.	Oz.	Oz.
Day old	1·3	.	1·36	..
1 week	1 97	1·64	2·14	1·53
2 weeks	3·31	3·36	3·61	3·32
3 weeks	5·31	4·80	5 84	5 05
4 weeks	7·61	6·46	8·68	7·20
5 weeks	9·94	7·58	12·08	6·89
6 weeks	12·92	8 96	15·86	10·62
7 weeks	16·65	8·65	20·17	13·95
8 weeks	20 41	13·29	25·31	15 05

The variation in weight from week to week and the ever-increasing amount of food required suggest the undesirability of indicating specifically what should be supplied.

The food requirements increase week by week, and a system of feeding where the growing birds may consume all they require is the more desirable.

The all-mash method of feeding chickens is suggested, because the kind of food consumed is easily controlled and it is always in front of the birds. All-mash should be placed in shallow trays about 1 inch in depth during the first few days. The trays should then be increased to a depth of 2 inches, and by the end of the first week troughs about 4 inches wide may be used. At this age chickens will commence to scratch, scattering the feed from the trough. This can be prevented by placing a piece of netting on top of the mash loose enough to sink as the mash is eaten. During the first week, 8 feet of feeding space should be allowed for every 100 chickens, and later increased to 12 feet. Before the mash is covered with netting, it is important that only a little food at frequent intervals should be placed in the trays in order

to avoid wastage. In fact, frequent feeding of all-mash appears to induce a greater food consumption, resulting in better development.

Breeders who do not desire to feed an all-mash may use commercial chick grains and growing mashes which may be fed as directed by the manufacturers. It has been the general custom for many poultry raisers to use scratch grain only for a short period of a chicken's life: but, in view of the more satisfactory results obtained by feeding a ration of a relatively higher protein content than chick mixtures usually have, early mash feeding seems to be essential.

Chickens may be reared satisfactorily on moistened mashes and grain from about two weeks of age, but the mashes should be fed at frequent intervals. This system has the advantage of utilising milk for moistening the mash when it is available. The feeding of dry mash, however, is suggested as a safer method of feeding, as the possibility of food becoming sour, with the probable consequence of bowel trouble among chickens, is avoided.

Suitable All-mash Mixtures.

Suitable all-mash mixtures for various classes of birds are given in Tables 1 and 2.

TABLE 1.

ALL MASH—CHICKENS DAY-OLD TO 6 TO 8 WEEKS.

Ingredient.	Mixtures.			
	1.	2.	3.	4.
Yellow Maize Meal	38	..	..	20
Wheat Meal	..	43	43	20
Sorghum Meal	..	20	20	25
Bran	20	20	15	10
Pollard	20	..	..	..
Lucerne Meal	..	..	5	5
Protein Meal (55 per cent.) ..	9	9	14	12
Buttermilk Powder	10	..	..	5
Liver Meal	..	5	..	..
Ground Limestone or Shell ..	1	1	1	1
Synthetic Riboflavin ..	..	..	As directed by vendor	As directed by vendor
Vitaminised Preparation ..	1	1	1	1
Manganese-Salt Mixture* ..	1	1	1	1
	100	100	100	100

* Manganese-salt mixture consists of a mixture of 4 ounces of commercial manganese sulphate and 20 pounds of commom salt.

If a good succulent green feed is not available to be fed in conjunction with these mashes a vitamin A preparation should be used as a supplement.

Owing to the impossibility of obtaining a wide range of ingredients, mixtures have to be very simple. Where bran is not available a good sample of crushed whole oats would make a useful addition. Oats of good quality are a valuable food. They have been omitted as they are not usually available.

TABLE 2.

ALL MASH—GROWING BIRDS 8 TO 20 WEEKS.

BIRDS HAVING ACCESS TO DIRECT SUNLIGHT.

Ingredient.	Ration.			
	1.	2.	3.	4.
Maize Meal	35	..	..	..
Wheat Meal	30	40	51	66
Sorghum Meal	..	22	12	..
Bran	10	10	..	20
Pollard	20	10	20	..
Lucerne Chaff (Leafy)	4	4	6	4
Protein Meal	5	8	9	6
Ground Limestone or Shell	1	1	1	1
Manganese-Salt Mixture	1	1	1	1
Liver Meal	4	..	..	2
Milk Powder	..	4	..	2
Synthetic Riboflavin	..	..	As directed by vendor	..

FARM FACTORS INFLUENCING MARKETING.

Marketing has to be considered in relation to (1) the egg; (2) table birds, including birds specially reared for the purpose, stock that have ceased to be profitable, and cockerels; and (3) poultry manure. The lastmentioned product is of increasing importance.

Marketing, particularly in the first stage, is certainly a function which definitely concerns every poultry-keeper. It is not merely the task of the Egg Boards or the commission agents. The poultry-keeper considerably influences the ease of marketing by the maintenance of egg quality. If every consideration is not given to the preservation of the quality of the egg as laid, the task of marketing is made most difficult. Producers should remember therefore that the earlier the egg reaches the consumer after being laid the better.

The principal factors influencing successful marketing are:—

(1) The production of infertile eggs.

(2) Clean and ample nests (one nest for every five birds). Eggs when laid are moist, and dust and other matter adhere to them.

(3) Gathering at frequent intervals to prevent eggs becoming soiled.

(4) Collecting in clean and dry receptacles.

(5) Storage (pending marketing) on the farm in cool quarters free from draughts and foreign odours.

(6) Regular and frequent despatch to market—twice weekly during warm weather; once weekly during winter.

(7) Using dry, clean fillers, and cases free from moulds when packing for market.

Careful attention to the quality of the egg is necessary, as quality influences demand.

The basis of the poultry industry is egg production, for which breeds—such as Leghorns and Australorps—are bred, Leghorns predominating. The classes of birds sold mostly for table purposes are young cockerels of both light and heavy breeds and hens culled because of their age, or for other reasons which make them unprofitable to keep as egg producers. Every producer has to consider such questions as the time of marketing, condition of stock, grading, and crating.

Most of the birds a producer has for sale are cockerels, which have to be sold during a relatively short period. They may be sold at various ages, each age having its special advantage. Although most buyers prefer young stock for table purposes, they will not pay high prices for small half-grown birds when larger hens are available, which would be proportionately much cheaper. It is not a sound practice, therefore, for the producer to send half-grown cockerels to the market and expect to receive good prices for them during the period when most old hens are being sold because of age. This period varies in duration, but usually extends from some time in January until April. Young half-grown birds will find a ready sale from August until the Christmas season. After then, young stock should be well grown to command good prices, but should not be kept until they become staggy, which is indicated by spur growth.

TABLE 3.
MASH–GRAIN RATIONS.

—	1.	2.	3.	4.	5.
	Per Cent.	Per Cent.	Per Cent.	Per Cent.	Per Cent.
Grain—					
Wheat	100	50	..	50	..
Maize	..	50	100	..	..
Sorghum	..	..	..	50	100
Mash—					
Wheatmeal	26	..	..	..	..
Maize Meal	..	18	10	..	..
Sorghum Meal	..	..	..	23	20
Crushed Oats	..	..	23	..	..
Bran	16	20	..	16	16
Pollard	33	31	40	34	36
Meat and Bone Meal ..	10	14	14	13	13
Buttermilk Powder ..	4	4	4	4	4
Linseed Meal	..	2	..	..	..
Lucerne Meal	10	10	8	9	10
Salt	1	1	1	1	1

Supplements—	
Vitamin A	Unnecessary if choice lucerne meal is fed; otherwise feed fish oils.
Calcium	Shell grit *ad lib* or ground limestone or oyster shell at 2 lb. per 100 lb. mash.
Synthetic Riboflavin ..	If buttermilk powder and liver meal are short, use synthetic riboflavin for breeders. In all rations buttermilk could be replaced by meat meal or linseed meal and synthetic riboflavin added.

It is necessary to give some attention to the general condition of the birds to be marketed. No good is done by sending in stock for sale in low condition, especially when it is considered that, in old hens particularly, there may be only a few in such a state. It is not suggested that any attempt be made to fatten birds of this class, as they are usually constitutionally unfit, and the producer's ends would be better served if they were destroyed, as it may happen that these particular low-conditioned birds will be first examined by prospective buyers, and their presence may depreciate the value of the whole consignment.

Cockerels, however, should receive some consideration and not be treated, as they often are, as an encumbrance and not worth feeding. If they are to be kept for any length of time at all, they should be well treated and receive the same attention as the pullets. They require, for economical growth, the same ration as the pullets; and should be kept free from intestinal worms and sold as early as possible.

Feeding systems for laying fowls vary. The most popular is the feeding of dry mash and grain, although the all-mash method is used by some. For those who desire to prepare their own mixtures rations given in Table 3 are suggested as a working basis.

Modern Milking Methods—A Correction.

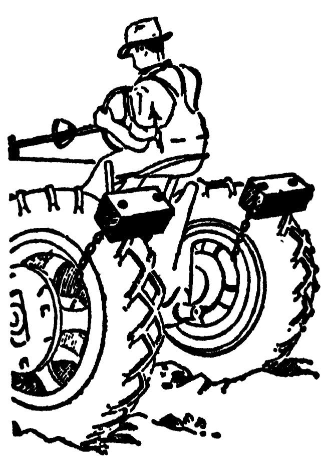
On page 158 of the March issue of the Journal it was stated that "In normal milking this stimulus (to milk let-down) is best provided by adequately washing the cow's teats and udder with warm milk (110 deg. F.)." As stressed in the detailed discussion of milking which followed, warm water and not milk should be used for washing the teats and udder.

To Pull Out a Bogged Tractor.

A hint for getting a tractor out of a sandy or muddy patch is given in "Handy Farm and Home Devices," which is selling on behalf of the Queensland Blinded Soldiers' Association.

As shown in the illustration, two pieces of 4 x 4 hardwood are fitted with eyebolts and short lengths of chain. The chains are just long enough to encircle the tyre and rim, and the blocks are attached as shown when difficulty is encountered in moving the tractor.

(The book is available from Mr. A. V. Loughrey, G.P.O. Box 1400R, Brisbane, for one guinea.)



Hand-feeding Sheep in Drought Time.

G. R. MOULE, Officer-in-Charge, Sheep and Wool Branch.

(Continued from page 238 of April Issue.)

CHOOSING DROUGHT RATIONS.

If it is decided to feed, the drought ration should be chosen upon:—

(i.) Availability of the foodstuff, which can be determined from market reports;

(ii.) The feeding value of the foodstuff and its cost per food unit;

(iii.) Suitability of the food for the purpose, including palatability and bulk/weight ratio, which is important from the point of view of ease of handling.

The value to the sheep of drought foods varies a good deal because of differences in their composition. These include variations in protein, carbohydrate and mineral contents, but to give an over-all figure as a basis for comparison the food value of each of the feeds most commonly used in Queensland is set out in Table 2. The values are given in percentage "drought food units," which is a composite term that takes into consideration the food value of the various feeds to drought-stricken sheep.

TABLE 2.

DROUGHT FOOD UNITS OF COMMON FOODSTUFFS.

Foodstuff.	Number of Drought Food Units per 100 lb. of Foodstuff.
Roughages—	
Cereal chaff	40
Lucerne chaff	40
Concentrates—	
Maize, wheat, barley, sorghum, linseed meal, and cottonseed meal	77
Meatmeal	70
Nuts (varies with brand; average figure only)	65
Oats	60
Molasses	52

When purchasing feed during drought it is essential to buy on a basis of food values. As the available foodstuffs vary considerably in food value, different amounts of individual feeds are required to maintain sheep.

This is shown in Table 3, which gives the number of sheep fully maintained by a bag of food per week as well as the number of tons per 1,000 sheep per month required for full maintenance.

TABLE 3.

SHEEP MAINTENANCE VALUES OF VARIOUS FOODSTUFFS.

Foodstuff.	Ounces Equivalent to 8 oz. of Maize.	Lb per Cornsack.	Sacks per Ton	Number of Sheep Fed at Rate of 8 oz. of Maize (or Equivalent) per Head per Day from 1 Sack.	Number of Tons at 8 oz. of Maize (or Equivalent) per Head per Day per 1,000 Sheep per Month
Roughages-					
Wheaten chaff .. .	15½	50	45	52	13
Lucerne chaff .. .	15½	80	28	77	13
Grains -					
Whole maize .	8	160	14	320	6·6
Crushed maize .. .	8	120	19	240	6·6
Wheat	8	175	13	350	6·6
Grain sorghum .. .	8	156	14	312	6·6
Oats	10	130	17	208	8·5
Manufacturers' By-products	—				
*Meatmeal	9	160	14	285	7·5
Nuts	9½	125	18	210	8·0
†Linseed oil meal ..	8	120	19	..	.
†Cottonseed meal ..	8	150	15	..	

* Doubtful if sheep would eat sufficient for complete maintenance.
† Inadvisable to attempt to maintain sheep fully on these feeds.

From this table it is seen that less of the grains or meals is required to maintain 1,000 sheep for a month than is needed when feeding the bulky foods such as chaff and hay.

The relationship between the bulk and the feeding value of the various foodstuffs is important, as it influences such things as ease of handling, storage, road transport and rail freight.

These facts have important practical application and Tables 4, 5, and 6 have been drawn up to enable a comparison to be made of the purchase price and costs of freight and handling charges for different foodstuffs required to provide 1,000 dry sheep with 8 oz. of maize per head per day (or its equivalent) for a 30-day month, at varying market rates and for different distances of haulage.

From a study of these tables it is seen that it is usually far cheaper to feed sheep on concentrates, such as grain, than on roughage such as lucerne or cereal hay.

Suppose maize can be purchased at £20 per ton and lucerne at £10 per ton. The actual purchase price of the food required to maintain 1,000 sheep for one month on maize or lucerne would be £132 (see Table 4).

TABLE 4.

COMPARATIVE MAINTENANCE COSTS PER 1,000 SHEEP PER 30-DAY MONTH FOR VARYING COSTS OF FEED.
(Each sheep given the equivalent of 8 oz. of Maize per day.)

Foodstuff.	Tons per 1,000 per Month.	Purchase Price per Ton. £1.	£2.	£3.	£4.	£5.	£6.	£7.	£8.	£9.	£10.
		£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.
Grain—											
Maize	6·6	6 12 0	13 4 0	19 16 0	26 8 0	33 0 0	39 12 0	46 4 0	52 16 0	59 8 0	66 0 0
Wheat	6·6	6 12 0	6 12 0	19 16 0	26 8 0	33 0 0	39 12 0	46 4 0	52 16 0	59 8 0	66 0 0
Grain Sorghum .	6·6	6 12 0	6 12 0	19 16 0	26 8 0	33 0 0	39 12 0	46 4 0	52 16 0	59 8 0	66 0 0
Oats	8·5	8 10 0	17 0 0	25 10 0	34 0 0	42 10 0	51 0 0	59 10 0	68 0 0	76 10 0	85 0 0
Manufacturers' By-products—											
Meatmeal ..	7·5	7 10 0	15 0 0	22 10 0	30 0 0	37 10 0	45 0 0	52 10 0	60 0 0	67 10 0	75 0 0
Nuts	8·0	8 0 0	16 0 0	24 0 0	32 0 0	40 0 0	48 0 0	56 0 0	64 0 0	72 0 0	80 0 0
Roughages—											
Lucerne Chaff ..	13	13 0 0	26 0 0	39 0 0	52 0 0	65 0 0	78 0 0	91 0 0	104 0 0	117 0 0	132 0 0
Cereal Chaff ..	13	13 0 0	26 0 0	39 0 0	52 0 0	65 0 0	78 0 0	91 0 0	104 0 0	117 0 0	132 0 0

TABLE 5.

COMPARITIVE RAIL FREIGHTS FOR MAINTENANCE OF 1,000 SHEEP PER MONTH ON DIFFERENT FEEDS CARRIED VARYING DISTANCES.

Feed.	Tons per 1,000 per Month	Rail Freight per Ton—Rebate Rates.																	
		10s			£1.			£2.			£3			£4.			£5.		
		£	*s.*	*d.*	£	*s.*	*d.*	£	*s.*	*d.*	£	*s.*	*d.*	£	*s.*	*d.*	£	*s.*	*d.*
Grains—																			
Maize ..	6·6	3	6	0	6	12	0	13	4	0	19	16	0	26	8	0	33	0	0
Wheat ..	6·6	3	6	0	6	12	0	13	4	0	19	16	0	26	8	0	33	0	0
Grain sorghum	6·6	3	6	0	6	12	0	13	4	0	19	16	0	26	8	0	33	0	0
Oats ..	8·5	4	5	0	8	10	0	17	0	0	25	0	0	34	0	0	42	0	0
Manufacturers' By-products—																			
Meatmeal	7·5	3	15	0	7	10	0	15	0	0	22	10	0	30	0	0	37	0	0
Nuts ..	8·0	4	0	0	8	0	0	16	0	0	24	0	0	32	0	0	40	0	0
Roughages																			
Lucerne chaff ..	13	6	0	0	13	0	0	26	0	0	39	0	0	52	0	0	78	0	0
Cereal chaff .	13	6	10	0	13	0	0	26	0	0	39	0	0	52	0	0	78	0	0

TABLE 6.

ROAD FREIGHT AT 1s. PER TON-MILE FOR VARIOUS FEEDS REQUIRED TO MAINTAIN 1,000 DRY SHEEP PER MONTH (30 DAYS) FOR DIFFERENT DISTANCES.

Feed.	Tons per 1,000 per Month.	Miles Carted													
		10.			20.			30.			40.			50	
		£	*s.*	*d.*	£	*s.*	*d.*	£	*s.*	*d.*	£	*s.*	*d.*	£	*s.*	*d.*
Grains—																
Maize ..	6·6	3	6	0	6	12	0	9	18	0	13	4	0	17	10	0
Wheat ..	6·6	3	6	0	6	12	0	9	18	0	13	4	0	17	10	0
Grain sorghum	6·6	3	6	0	6	12	0	9	18	0	13	4	0	17	10	0
Oats .. .	8·5	4	5	0	8	10	0	12	15	0	17	0	0	21	5	0
Manufacturers' By-products—																
Meatmeal ..	7·5	3	15	0	7	10	0	11	5	0	15	0	0	18	15	0
Nuts	8·0	4	0	0	8	0	0	12	0	0	16	0	0	20	0	0
Roughages—																
Lucerne chaff	13	6	10	0	13	0	0	19	10	0	26	0	0	32	10	0
Cereal chaff ..	13	6	10	0	13	0	0	19	10	0	26	0	0	32	10	0

However, if the rail freight at drought rebate rates is £3 per ton on the feed and if it has to be carted 20 miles from the rail head, the handling charges will be approximately as follows:—

	£	s.	d.
Maize:			
Rail freight—6·6 tons at £3 per ton ..	19	16	0
Road haulage—6·6 tons at £1 per ton ..	6	12	0
	26	8	0
Chaff:			
Rail freight—13 tons at £3 per ton ..	39	0	0
Road haulage—13 tons at £1 per ton ..	13	0	0
	52	0	0

Although the purchase prices are the same, the handling charges on the chaff are double those on the grain, and this represents quite an important expense.

The prices taken in the example are not exactly comparable for drought purposes, because there is seldom such a difference in favour of lucerne. Supposing good quality hay could have been bought at £18 per ton, the monthly cost of feeding it to 1,000 dry sheep at a rate equivalent to 8 oz. of maize per head per day would have been £234. Maize, wheat, and grain sorghum would have to be almost £40 per ton before they would cost as much.

The main success in buying drought feeds depends upon following the changes in the market. The 1948 drought gave several good examples of this. Early in 1948 grain sorghum was available at about £9 per ton (Brisbane) and this was the cheapest feed to buy. Subsequently, the price of sorghum rose steeply, but maize was available at about £14 per ton (Brisbane). When its price was decontrolled it rose rapidly but feed wheat became available at £9 10s. per ton (Brisbane). During the whole of this period lucerne was quoted at from £14 to £18 per ton. In these circumstances the most economical way of feeding sheep was to purchase grain sorghum initially, then maize, and finally wheat when the price of maize rose. By doing this one woolgrower fed sheep at less than half the cost incurred by other men in the same district who fed full rations of lucerne continuously.

This raises the question of the necessity of feeding roughage to drought-stricken sheep. It has been found that roughage is not necessary for the well-being of adult sheep, but is required for young animals, and field experience under drought conditions confirms this observation.

On the other hand, most men like to give their sheep some roughage, and a mixture in the ration is of value because sheep which do not eat one feed well will often eat another and by feeding a small amount of good quality roughage with grain, losses can be minimised. One of the most economical and successful rations fed during the 1948 drought consisted of 8 oz. of crushed grain plus 2 oz. of lucerne per head per day. This was equivalent to about 9 oz. of grain per head per day.

THE SUITABILITY OF FOODSTUFFS.

Another important point to consider in purchasing feed is its suitability for drought feeding. The main points to consider in this connection may be summarised as follows:—

Grains.

Maize.

Maize is very rich in starch and this strengthens weak sheep quickly. The grain has comparatively little protein and accordingly it should be supplemented with some protein-rich meal. Maize is rich in vitamin A, but like other cereal grains is poor in lime. It is easy to feed, as it can be broadcast on the ground. However, it is preferable to feed it in troughs and this is essential when it is cracked and/or a concentrated meal is added to the ration.

Wheat.

Wheat is not so popular in Queensland as maize, though it has about the same feeding value. Like maize, it has not a high protein content and accordingly it is preferable to add some protein-rich supplement such as meatmeal, cottonseed meal or linseed oil meal to the ration. Wheat is not rich in vitamin A or lime. It should be rolled and trough fed, and the quantity controlled because of the possibility of over-engorgement.

Grain Sorghum.

Grain sorghum is a useful drought food with a feeding value close to that of maize. It is not rich in vitamin A and has a low lime content. The supply is usually good and in the past it has been one of the cheapest feeds when considered in the light of its high food value. Grain sorghum is extremely hard and must be crushed and fed in troughs. It is necessary to control the daily intake.

Oats.

Oats, though a good feed, are not used extensively. The main reasons for their apparent lack of popularity are high price and short supply. Their feeding value is not as high as that of the other grains, but they contain more fibre; this satisfies hungry sheep and tends to stop them from wandering; in addition it makes the grain extremely useful for young sheep. They are not rich in minerals. Oats must be trough fed. When available, they can be used instead of lucerne and maize together.

Manufacturers' By-products.

Cottonseed Meal.

Cottonseed meal is very rich in protein and high in over-all drought food value. It is quite palatable and has an added advantage in that it colours the muzzle of sheep which eat and non-eaters can thus be detected readily. It is extremely useful to add to hay or grain rations as a protein-rich supplement, in which case the daily rate of feeding should not exceed 4 oz. per head. It is unsuitable for a complete maintenance feed for lengthy periods by itself. Cottonseed meal must be trough fed.

Linseed Oil Meal.

Linseed oil meal is relished by sheep and is well known as a "good woolgrowing feed." As a drought food linseed has about the same value as maize, but it is richer in protein. It is unsuitable as a complete maintenance ration and if fed at more than 4 oz. per head per day it may cause scouring. It is most useful as a source of protein to supplement a cereal grain or hay ration. Linseed oil meal must be trough fed.

Meatmeal.

Meatmeal is a useful source of protein and its feeding value is high. It is usually reasonably cheap, but it is not particularly palatable. Accordingly, it can be used most effectively as a protein-rich supplement fed with cereal grains or chaff or hay. Naturally, meatmeal must be trough fed and should be mixed with some palatable food.

Bonemeal.

Several brands of sterilized bonemeal are on the market and are useful in augmenting the scanty mineral content of the cereal grains. About 1 per cent. of finely ground bonemeal should be added to all rations consisting mainly of cereal grains. Lime may also be used provided it is finely ground and is free from such contaminants as lead and arsenic.

Nuts.

Several brands of nuts made from various by-products and crushed grains are marketed and they usually have a fairly high food value—somewhere between maize and oats, depending on the brand. Nuts can be broadcast on the ground but care must be taken to see that the sheep do not go "nut happy" and chase after the truck from which they are distributed.

Roughages.

Lucerne.

Lucerne is available as hay or chaff. The former is probably the easier to feed. Lucerne has quite fair food value. It is rich in protein, in minerals, and, if it has not been stored long, in vitamin A. It also contains ample fibre and is therefore useful for young sheep, but the cost, freight and handling charges are often excessive.

Cereal Hay or Chaff (Oaten or Wheaten).

It is wasteful to feed cereal hay, as a lot of grain is lost, and chaff is of doubtful value for young sheep for roughage as it tends to blow away. The feeding values of oaten and wheaten chaff are comparable, but because of high freight and handling charges cost may be a disadvantage.

THE PRACTICE OF FEEDING.

In undertaking hand feeding of sheep in drought time several initial decisions must be made. These are:—

(i) When should feeding commence?

(ii) How much feed should be given to the sheep?

(iii) How should the feed be offered?

(iv) Which sheep should be fed and how should the flock be managed generally?

Commencing to Feed.

The decision as to the time of commencing feeding depends largely upon the location of the property. Generally speaking, graziers in the northern and central part of the State would be well advised not to commence feeding as soon as it becomes obvious that the summer rains have failed. In those areas the chances of relief from winter rains are remote and, unless there are particular circumstances—such as lambing ewes or special blood lines which it is desirable to preserve—complete hand feeding cannot be recommended before the late winter or early spring. By that time there are three chances in four that the drought will break within six months. On the other hand, it is not advisable to let the sheep get too weak before commencing to feed.

Should summer rains fail, it is possible in the majority of cases to get a fairly definite indication from the condition of the sheep, their history (that is, whether they have been joined or not, age, &c.), the state of the pasture, the amount of top feed and the water supplies, as to the chances of the flock battling through to the next most likely rain period. Should there be no chance of the majority of animals getting through it is better to take immediate action to reduce numbers and seek agistment. If, on the other hand, there seems some chance of the flock being able to pull through, though it is realised feeding may have to be practised, it is better to commence feeding fairly early in order to preserve and strengthen the condition of the sheep. In addition at this time food costs are usually lower.

From the point of view of sheep feeding a drought might be broken into three stages:—

(1) The period when the sheep enter the drought and commence to fall gradually in condition. In this stage they may slip to below forward store condition but they should not be allowed to go past good strong store condition. At this stage, there is usually some roughage available but it may be of comparatively low nutritive value.

(2) In the second stage if they are not fed the sheep slip from good strong store condition to one approaching weakness. By this time the pasture is falling off very rapidly in quantity and quality.

(3) The third stage is when the sheep are definitely weak and deaths are likely. At this stage grass is virtually non-existent.

Feeding should commence in the first stage and the initial ration might be regarded as a supplement. It could consist of salt, finely ground limestone and a meal such as meatmeal, linseed meal, cottonseed meal, and/or crushed grain sorghum or maize meal mixed in the proportions of 30, 35 and 35. The mixture can be bound with a little dilute molasses and can be fed from troughs at the rate of 1 to 2 oz. per head per day depending on the class of sheep being fed. The object of this supplement is to prevent the sheep from becoming weak through drawing on their body stores, and to accustom them to a procedure which may become continuous.

As the pasture deteriorates and the second stage is approached it becomes necessary to increase the amount of nutriment offered to the sheep. The quantity of salt and limestone can be decreased and the proportion of meal increased and it may be necessary to feed more than 2 oz. per head per day.

How Much Feed is Required.

As the position deteriorates the amount of feed must be increased. Table 7 shows the quantities which must be given to adult dry ewes during the various stages of drought. In interpreting the table, it is as well to remember that the owner should be the best judge of the condition of his sheep and he should vary their ration as required.

TABLE 7.

AMOUNTS OF FEED REQUIRED BY ADULT DRY EWES AT VARIOUS STAGES.

Feed.	Entering Drought.		Some Roughage Available		Practically no Roughage.	
	Ounces per Sheep per Day.	Bags per 1,000 Sheep per Day.	Ounces per Sheep per Day.	Bags per 1,000 Sheep per Day.	Ounces per Sheep per Day.	Bags per 1,000 Sheep per Day.
Grains—						
Maize ..	3·0	1·15	6·0	2·3	9·0	3·5
Wheat ..	3·0	1·05	6·0	2·1	9·0	3·2
Grain Sorghum	3·0	1·20	6·0	2·4	9·0	3·6
Oats ..	4·0	2·0	8·0	4·0	12·0	6·0
Manufacturers' By-products—						
Nuts ..	3·75	2·0	7·5	4·0	11·25	6·0
Roughages—						
Cereal Chaff	No real need to feed roughages during these stages.				17·5	13·5
Lucerne Hay					20·0	20·5

Naturally, the total ration must be modified according to age and class of the sheep and the various foodstuffs used.

If the sheep are in reasonable condition when feeding commences it does not matter very much if they do lose weight gradually. In fact, it is most economical to let them do so, provided they do not become weak. Actually, when the sheep are losing weight they are living partly on their own tissues; it is interesting to note that every 1 lb. of body tissues used in this way provides an amount of energy almost equivalent to that obtained from feeding 4 lb. of maize.

TABLE 8.

AMOUNTS OF FOOD FOR VARIOUS CLASSES OF SHEEP.

Class of Sheep.	Oz. of Maize (or equivalent) per Head per Day.
Ewes (within 2 months of lambing)	12
Dry Ewes	9
Ewe Weaners (under 7 months)	4 + protein and roughage

In some field trials conducted in Queensland in 1936 a group of sheep averaging 70 lb. liveweight were fed for 14 weeks on 5½ oz. of wheat plus 2½ oz. of nuts per head per day. Their average weight fell by 7 lb. to 63 lb. per head and the ration was about equivalent to 7½ oz. of maize. Nine ounces of maize per head per day would have probably maintained the sheep at about 70 lb. liveweight, but this would have taken approximately an additional 1¼ tons of maize per 1,000 sheep per month. Allowing the sheep to lose 7 lb. liveweight was not very serious from the point of view of the well-being of the flock, but the cash saving was rather important.

Table 8 indicates the proportions which might be given to the various classes of sheep, expressed in ounces of maize per head per day.

Suppose it is desired to feed dry ewes, and maize and lucerne hay are available at reasonable prices. A ration of 8 oz. of maize plus 2 oz. of lucerne per head per day is equivalent to 9 oz. of maize per head per day, as the feeding value of lucerne is only about half that of maize. This necessitates substituting 2 oz. of lucerne for 1 oz. of maize.

Likewise, because of their different feeding values, about 8 oz. of lucerne plus 5½ oz. of nuts per head per day are equivalent to 9 oz. of maize per head per day. Comparable rations can be calculated from the information on the number of drought food units per 100 lb. of foodstuff in Table 2. Table 9 gives the weight of the various foodstuffs which might be substituted for varying quantities of maize.

TABLE 9

WEIGHTS OF VARIOUS FOODSTUFFS EQUIVALENT TO VARIOUS AMOUNTS OF MAIZE.

	Ounces.								
Grains—									
Maize	1·0	2·0	3·0	4·0	5·0	6·0	7·0	8·0	9·0
Wheat	1·0	2·0	3·0	4·0	5·0	6·0	7·0	8·0	9·0
Grain Sorghum	1·0	2·0	3·0	4·0	5·0	6·0	7·0	8·0	9·0
Oats	1·3	2·6	4·0	5·3	6·6	8·0	9·3	10·6	12·0
Manufacturers' By-products—									
Nuts	1·25	2·5	3·75	5·0	6·25	7·5	8·75	10.0	11·25
Meatmeal	1·0	2·0	3·0	4·0	Inadvisable to feed beyond this level.				
Linseed Meal	1·0	2·0	3·0	4·0					
Cottonseed Meal	1·0	2·0	3·0	4·0					
Roughages—									
Cereal Chaff or Hay	2·0	4·0	6·0	8·0	10·0	12·0	14·0	16·0	18·0
Lucerne Chaff or Hay	2·0	4·0	6·0	8·0	10·0	12·0	14·0	16·0	18·0

From this table it is readily seen that about 4 oz. of lucerne hay plus about 8½ oz. of nuts are equivalent in feeding value to 9 oz. of maize. Similarly 6½ oz. of oats plus about 5 oz. of nuts are approximately equal in feeding value to 9 oz. of maize.

Some Special Requirements in Drought Feeding.

Special attention should be given to young sheep, to ewes heavy in lamb and to rams. If lambs are being fed it is essential to give them roughage to develop their paunch (or first stomach) and to teach them to chew their cud. Growth is essentially a period of protein storage and for this reason adequate protein must be included in the ration. If roughage has to be purchased for the young sheep, lucerne is most suitable because it contains adequate protein, minerals and vitamin A, so necessary for young animals.

Although it may be expensive it is better to feed the lambs and weaners well, as they constitute one of the most important parts of the flock and a check in growth during their early life may decrease their earning capacity forever. A ration consisting of 4 oz. of maize and 8 oz. of lucerne per head per day would be adequate in energy content for young sheep but may not contain enough protein and it would be preferable to decrease the maize a little and substitute a protein-rich meal, such as cottonseed or linseed meal.

Pregnant ewes require additional food to provide for the lambs they are carrying. Three ounces of maize per head per day or its equivalent, in addition to the maintenance ration, should be sufficient if it is fed during the last two months of pregnancy. Extra protein may be included in the ration at this time to stimulate the milk supply. This would only be done if it was desired to save the lambs.

Rams require special attention because they are often put to work as soon as the drought breaks. It has been conclusively shown that rams which have been subjected to long periods of vitamin A deficiency, as occurs during drought time, may become comparatively infertile. In addition, sufficient protein is required to permit normal sperm formation. Accordingly, it is as well to feed rams a ration rich in protein and vitamin A. Several ram meals designed to meet these requirements are available, but, if it is desired to feed the rams from the store of food on hand, it is advisable to give them lucerne, maize and a protein-rich meal in the proportions of 8 : 8 : 4 ounces per head per day.

One other special requirement for which there is not often a demand in Queensland, but which is important nevertheless, is the additional fibrous food needed during cold weather. The fibre in most foodstuffs is utilized for heat production and during cold weather it is advisable to feed increasing quantities of roughage to assist the sheep in "keeping themselves warm."

As the cereals are notoriously deficient in minerals, it is always necessary to include 1 per cent. of finely ground limestone in a drought ration composed entirely or almost entirely of these grains.

[TO BE CONTINUED.]

Care of Mother and Child.

THE CRYING BABY.

GENERALLY when a baby cries it is a sign that he is uncomfortable and he wants help. He might be hungry; he might be thirsty; he might have a distended stomach from overfeeding; he might want his soiled napkin changed, or his crumpled sheets straightened out. He might want an irritating safety pin moved. He might be too hot or too cold. All these physical causes can easily be remedied.

But what of the psychological or emotional causes? Few people realise that a baby is born with psychological attributes and these are no less important or prominent that his physical attributes. No two babies are alike in their make up, their needs or their demands, and consequently their care and training need to be particularised. The emotions of the infant begin to unfold early and his habits alter as he grows older. He has his good days and his bad days. Sometimes nothing will satisfy him and these moods are put down to teething, which is incorrect.

Repeated yielding by parents often makes a tyrant out of a child and the older he grows the worse this selfish attitude becomes. Unless checked before this disposition becomes a part of their personality, many of these children grow up bullies or day dreamers and reach maturity as misfits.

The following rules properly applied will, by preventing the baby from getting into the habit of crying, save mothers coming home from hospital a lot of unnecessary worry:—

1. Have your baby examined by a competent physician. If he tells you that baby is all right, believe him.
2. A good lusty cry for a few minutes does no harm. It is an indication of good health.
3. When baby begins to cry, try to make him comfortable. If it is not near his feed time, offer him a bottle of warm water. If it is close to feeding time and he is still crying, feed him. Some children will choose a three-hour, others a four-hour feeding time, but whatever is chosen a certain amount of elasticity must be allowed. Be guided by the baby and not by the clock.
4. If after emptying the bottle he goes to sleep you can assume that he was hungry, and if this continues several times during the day you can be sure that he needs more food.

   If a breast-fed baby cries two hours after he is fed, and on being fed again goes to sleep and repeats this performance he is just telling you that he is not getting enough to satisfy him for three or four hours.

   But if an infant cries before, during, and after feeding, putting more food in his stomach will not help him. This type of crying should be investigated to exclude any physical upset.
5. The babe might be one of those sensitive infants who require some medicine to calm them.

6. If your babe is one of those who demand extra attention, treat him with tolerance and understanding. Let him cry it out. It is far better to do this a few times, when the infant will learn that it is waste of time, than to give in, and spend months of misery with a tyrannical child.

USE COMMON SENSE IN FEEDING BABY.

In spite of criticism of the "modern mother" it can safely be said that the mother—and father too—of 1949 who have looked forward to the arrival of their new baby and loved it from the moment they saw it are just as keen to do their very best for it as the parents of previous generations. We must admit that they have greater opportunities for extending their knowledge of child care—Child Welfare Centres, Kindergartens, the Press, the radio, and booklets and pamphlets all offer to parents the results of the experience of medical child specialists, nurses and kindergarteners who have worked for many years in the field of infant and child welfare.

Mothers and fathers undoubtedly need instruction and guidance in the bringing-up of their children.

Our knowledge that the foundations of a child's mental, physical, and emotional health are laid for good or ill in the first five years of life adds emphasis to this statement. The relatively small size of the present day family will result in generations of young mothers who have no personal knowledge of babies in their own homes and may never have handled an infant before their own first babies arrive.

How terrifying this predicament can be, no one but these mothers themselves can realise.

So a guide must be found.

If the guide is a person experienced in the ways of babies and wise in giving of that experience all will be well, because he or she will encourage the mother to make her own observations about her own particular baby and act on them when it seems the sensible thing to do.

But mother may choose for her guide one of the numerous baby books which says that babies must be fed regularly three- or four-hourly and that this and that are procedures to be followed. Instead of using this book as the guide it was meant to be, the harassed, inexperienced young mother may persist in regarding it as infallible and then trouble may arise.

We can affirm at this stage that the majority of babies do well on a three- or four-hourly feeding interval. In fact, as a result of an experiment carried out in 1947 on 100 American babies it was found that, *left to themselves*, all these babies with one exception established a regular two-, three-, or four-hourly feeding rhythm by 1 month of age and by 3 months had "put themselves" on to four-hourly feedings.

Grandmother did not feed her baby "by the clock," but with her generally much larger family and with fewer conveniences in her home she would not be likely to feed her baby oftener than the three- or four-hourly interval which he no doubt established for himself.

However, even with this in mind a mother must use common sense in the feeding of her own baby. If he leaves hospital on a four-hourly feeding and persistently wakes and seems hungry at three and a-half hours she should feed him then and not struggle for another half hour with a screaming, ravenous baby who will doubtless when the routine feeding time comes "gobble" his food and have wind and indigestion as a result.

The very sleepy baby who goes to sleep at the breast and therefore takes an insufficient amount of food per day needs to be fed when he is wide awake and hungry, regardless of his regular schedule.

The difficult baby who fights or refuses to suck should be fed when he is quiet and peaceful and mother thinks he might feed, even though he is not "due" for another hour.

Books on infant welfare by acknowledged authorities can be and are a tremendous help to parents, but mothers must remember that each baby is an individual and no book could ever entirely take the place of the personal observations of the intelligent, loving mother on her own particular baby as she grows in her own knowledge and experience of him.

If you have any problem in connection with this or other matters connected with children, advice may be obtained by communicating personally with the Maternal and Child Welfare Information Bureau, 184 St. Paul's Terrace, Brisbane, or by addressing letters "Baby Clinic, Brisbane." These letters need not be stamped.

ASTRONOMICAL DATA FOR QUEENSLAND.

JUNE.

By W. J. NEWELL, Hon. Secretary of The Astronomical Society of Queensland.

TIMES OF SUNRISE AND SUNSET.

At Brisbane.			MINUTES LATER THAN BRISBANE AT OTHER PLACES.					
Day.	Rise.	Set.	Place.	Rise.	Set.	Place.	Rise.	Set.
	a.m.	p.m.						
1	6.30	5.00	Cairns	8	50	Longreach	26	43
6	6.32	5.00	Charleville ..	24	30	Quilpie .	37	33
11	6.34	4.59	Cloncurry .. .	36	63	Rockhampton .	0	19
16	6.36	5.00	Cunnamulla	32	27	Roma .. .	15	19
21	6.38	5.00	Dirranbandi .	22	16	Townsville ..	8	42
26	6.39	5.02	Emerald	11	28	Winton	29	52
30	6.39	5.03	Hughenden ..	21	49	Warwick	5	3

TIMES OF MOONRISE AND MOONSET.

At Brisbane.

Day.	Rise.	Set.
	a.m.	p.m.
1	10.21	8.54
2	11.06	9.59
3	11.46	11.04
	p.m.	
4	12.22	..
		a.m.
5	12.56	12.08
6	1.29	1.11
7	2.04	2.15
8	2.41	3.21
9	3.23	4.28
10	4.11	5.37
11	5.06	6.45
12	6.05	7.48
13	7.07	8.45
14	8.09	9.33
15	9.08	10.14
16	10.05	10.50
17	10.59	11.21
18	11.51	11.49
		p.m.
19	...	12.16
	a.m.	
20	12.42	12·43
21	1.34	1.12
22	2.28	1.42
23	3.24	2.16
24	4.23	2.57
25	5.23	3.44
26	6.24	4.38
27	7.23	5.39
28	8.16	6.45
29	9.04	7.51
30	9.46	8.57

MINUTES LATER THAN BRISBANE (SOUTHERN DISTRICTS)

Charleville 27; Cunnamulla 29; Dirranbandi 19;
Quilpie 35; Roma 17; Warwick 4.

MINUTES LATER THAN BRISBANE (CENTRAL DISTRICTS).

Day.	Emerald.		Longreach.		Rockhampton.		Winton.	
	Rise.	Set.	Rise.	Set.	Rise.	Set.	Rise.	Set.
1	10	29	26	44	0	19	28	52
6	20	19	36	35	11	10	42	40
11	30	9	46	24	21	0	54	26
16	24	13	41	29	16	3	47	32
21	15	23	31	39	7	14	35	45
26	9	30	25	45	0	21	26	54
30	13	25	28	41	3	16	31	47

MINUTES LATER THAN BRISBANE (NORTHERN DISTRICTS).

Day.	Cairns.		Cloncurry.		Hughenden.		Townsville.	
	Rise.	Set.	Rise.	Set.	Rise.	Set.	Rise.	Set.
1	6	51	35	64	20	50	6	43
3	15	40	40	58	25	43	14	34
5	27	35	48	55	33	40	22	30
7	38	23	56	45	41	30	32	20
9	50	10	64	37	48	23	41	10
11	56	3	68	32	52	18	46	4
13	54	3	67	32	51	18	44	4
15	46	9	62	36	47	22	38	9
17	37	19	55	43	40	28	31	17
19	27	29	48	50	33	35	22	25
21	21	38	44	57	29	42	18	33
23	12	48	38	62	23	48	11	40
25	5	55	35	67	19	52	5	45
27	2	55	33	67	17	52	3	45
29	8	48	36	62	21	48	8	40
30	13	42	39	59	24	44	12	36

Phases of the Moon.—First Quarter, June 4th, 1.27 p.m.; Full Moon, June 11th, 7.45 a.m.; Last Quarter, June 18th, 10.29 p.m.; New Moon, June 26th, 8.02 p.m.

On June 22nd at 4.03 a.m. Eastern Australian Standard Time, the Sun will reach its maximum angle north of the equator and will then shine directly over the tropic of Cancer and from Queensland generally will rise and set 25 degrees north of true east and true west respectively.

On the 6th and 27th the Moon will rise and set almost at true east and true west respectively.

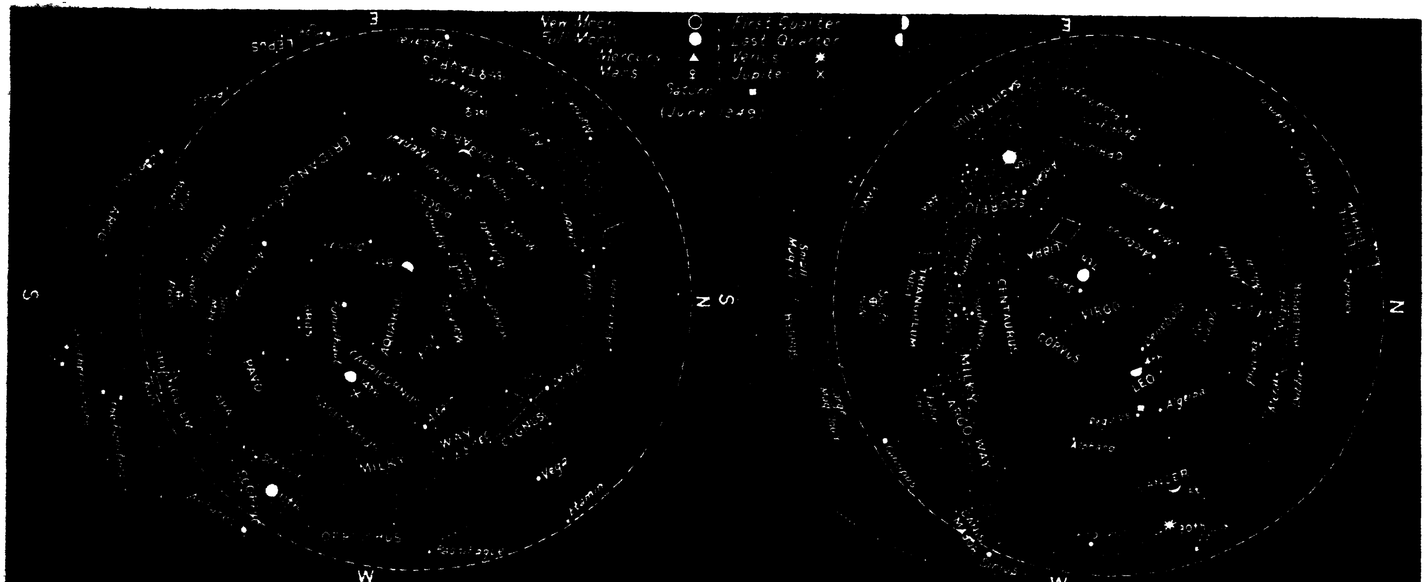
Mercury.—At the beginning of the month will be an evening object setting soon after sunset and will be in line with the Sun on the 3rd after which it will become a morning object reaching greatest angle west of the Sun on the 28th and rising 1¾ hours before the Sun by the 30th.

Venus.—Now an evening "star" visible low in the west during evening twilight. At the beginning of June, in the constellation of Taurus, will set 45 minutes after the Sun and at the end of the month will set 1¼ hours after the Sun.

Mars.—In the constellation of Taurus, at the beginning of the month will rise 1 hour 15 minutes before the Sun and at the end of the month, 1¾ hours before the Sun.

Jupiter.—Now an interesting object in the constellation of Capricorn, in the eastern evening sky. At the beginning of June it will rise between 8.30 p.m. and 9.45 p.m., and at the end of the month between 6.30 p.m. and 7.45 p.m.

Saturn.—Now seen in the western evening sky, setting between 11 p.m. and midnight on the 1st and between 9 p.m. and 10.15 p.m. on the 30th.



Star Charts.—The chart on the right is for 7.15 p m in the south-east corner of Queensland to 8 15 p m. along the Northern Territory border on the 15th June. (For every degree of longitude we go west, the time increases by 4 minutes.) The chart on the left is for 10 hours later. On each chart the dashed circle represents the horizon as viewed from Cape York and the dotted circle the horizon for places along the New South Wales border. When facing north hold "N" at the bottom; when facing south hold "S" at the bottom and similarly for the other directions. Only the brightest stars are included and the more conspicuous constellations named The stars which do not change their relation to one another, moving east to west, arrive at any selected position about 4 minutes earlier each night Thus, at the beginning of the month the stars will be in the positions shown about 1 hour later than the time stated for the 15th and at the end of the month about 1 hour earlier than that time. The positions of the moon and planets, which are continually changing in relation to the stars, are shown for certain marked days. When no date is marked the position is for the middle of the month.

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11

Contents

The Handling and Storage of Maize on the Atherton Tableland.

W. R. STRAUGHAN, Senior Adviser in Agriculture.

MAIZE growing on the Atherton Tableland commenced over 60 years ago. In the beginning, following the falling and burning of the rain forest, seed was hoed in amongst the stumps. Later the hoe gave way to the single furrow "swing" plough, but the stumps remained for many years in the paddocks before being finally removed.

The industry received a big impetus with the introduction of closer settlement following the first World War; the area sown to maize rose rapidly and has for nearly a quarter of a century approximated 25,000 acres, or 11-12 per cent. of the State's total.

The area cropped is intensely concentrated and is almost entirely encompassed within three-mile radii of the townships of Atherton, Tolga and Kairi, which themselves are within six miles of one another (see Plate 156). The three nests of storage silos are situated in these centres. The maize area is in fact the most concentrated area under maize in the Commonwealth of Australia and lends itself admirably to a system of unified control, such as is at present employed through the Atherton Tableland Maize Marketing Board.

It is the purpose of this article to briefly describe this system, but before doing so it would be an advantage to make some reference to weather conditions and their influence on cropping routine and particularly to the variance of the latter from southern practices.

GROWING CONDITIONS.

The average annual rainfall in the maize areas of the Tableland is 52 inches. Distribution follows the general seasonal pattern for the remainder of the State in that three-quarters of the total is registered during four summer months, December to March. It differs in that falls are usually of lower intensity and of longer duration, providing persistently damp conditions somewhat peculiar to the district and

Plate 156.

PHOTOGRAPH OF PORTION OF THE BUREAU OF INVESTIGATION'S LAND UTILISATION MAP OF THE ATHERTON TABLELAND.—The plain light area represents cultivated land used primarily for the production of maize and dairy forage crops; the hached area is land devoted to dairy pastures, the spotted area is open forest or scattered timber, and the dark areas State forests, timber reserves or National Parks.

which, although promoting rapid plant growth, present difficulties for the storage of grain without the aid of artificial drying and weather-proof storage facilities.

The crop, as elsewhere, is sown in drills about 4 feet apart, but the rate of seeding is much lower and the stand seldom reaches 33 plants per row chain. Plants grow rapidly and usually reach up to 12 feet in height. Owing to continued wet weather in most seasons, interrow cultivation is frequently hampered. Prolific weed growth, which usually develops after cultivation ceases and as the maize crop nears maturity, does not appear to have any material effect upon yield, although it may cause inconvenience at harvesting, particularly when machines are employed.

The varieties grown are peculiar to the locality and have been developed within the area from introduced strains. Cobs are large, with a heavy husk covering. The grain is large, inclined to be softer and starchier, lighter in colour and, as a result of wet climatic conditions, of higher moisture content at harvest time than southern grown maize.

Yields are relatively high, the average for the district over the past 25 years being 32 bushels of sound grain per acre. Yields of 80 or more bushels per acre have been reported for individual farms.

As elsewhere, the crop is subject to diseases of the cob, mainly Diplodia ear rot. These cob rots can become very severe in seasons favourable to disease; for example, if wet and showery weather is experienced during the cob's development, normally in March and April.

No economic control of cob rots in the field has been developed and as a consequence diseased ears have to be rejected from the harvest, since their inclusion would not only materially reduce the appearance and sale value of the product but would also cause trouble in storage. Cob rots are one of the major factors adversely affecting yield.

THE ATHERTON TABLELAND MAIZE MARKETING BOARD.

The difficulties experienced in handling maize as a result of local weather conditions and the marketing problems arising from distance from large markets, together with the unique concentration of the industry, induced farmers to seek a solution to their many problems in co-operation.

In 1923, therefore, growers, taking advantage of the facilities offered under the *Primary Producers' Organisation and Marketing Acts*, formed a Maize Pool and undertook the erection of storage silos and the installation of artificial drying conveniences for the handling and marketing of their commodity. The first crop to be handled by this organisation and with these facilities was that for the season 1924-25, when 17,099 tons of maize were handled and marketed on behalf of Tableland growers.

Over the past quarter of a century, covering 24 completed crops, deliveries to the Pool have totalled 389,703 tons, or an annual average of 16,238 tons.

Although production in the district has fluctuated from season to season, deliveries have remained at a consistently high level, there being only three occasions on which less than 11,000 tons was received by the Board.

During this period, the Board has developed a system of bulk handling which has been attended with a large measure of success. Success is gauged by the price paid to growers for maize; this, after all shelling, handling, bagging, administrative and incidental costs have been deducted, has averaged £8 1s. 8d. per ton for the past quarter of a century. This price, if coupled with the value of the Board's accumulated assets of buildings and machinery over the period, would therefore represent the equivalent of a payment of nearly 5s. per bushel for maize shelled, bagged and delivered at railway sidings by maize growers in other parts of the State.

HARVESTING.

Manual Picking.

Harvesting usually commences in May or early June and continues for several months, terminating some time in October, just prior to the planting of the succeeding crop.

Plate 157.

HAND PICKING OF MAIZE.—The cobs are pulled by hand, dehusked, and thrown into the carts.

Until recently, harvesting has been almost entirely by hand. Cobs are husked on the stalk, snapped off and then cast into light carts, which are "boarded up" on one side and along the front (Plate 157) as an aid to the manual picker, whose tossed cob usually strikes the "board" and falls back into the vehicle. At this time diseased cobs are rejected; they are generally deposited in bags fastened to the cart or into a small sectioned-off portion in the cart itself, since, although unsuitable for delivery to the Board, they have a use in the home feeding of farm animals. Carts are emptied into the farmer's barn, where the harvest awaits delivery to the Maize Board.

In earlier years, pickers were highly skilled in this work and, at a contract rate of 18s. to 25s. per ton, found a remunerative living in maize harvesting. Lately, however, lack of skill and the rising cost of living have forced picking rates up to over £2 per ton and this, coupled with the extreme shortage of available labour, has greatly influenced the introduction of mechanical harvesting.

Mechanical Harvesting.

Maize harvesters or " picker-husker " machines are designed to pick or snap the cob from the plant, remove the husk and deliver the husked cob into an attached trailer. They are quite distinct in design and operation from the standard small grain header-harvesters which have also been successfully employed to some extent in maize harvesting in other parts of the State.

Excluding the " picker-sheller," which picks and shells the grain, these machines may be grouped into four distinct types:—

1. *Mounted or Push Types.*—These are completely mounted on and supported by the tractor.

Plate 158.

MECHANICAL HARVESTING OF MAIZE.—Rear view of a two-row pull type picker at work on the Atherton Tableland.

2. *Semi-mounted Type.*—In this type the machine is partly supported on the rear of the tractor and partly on its own chassis and ground wheel or wheels. Normally the manufacturers regard this type as a pull type.

3. *Pull Type.*—The machine is completely carried on its own chassis and wheels and is drawn behind the tractor (Plates 158 and 159).

4. *Auto-type.*—This type has the power unit as an integral part of the machine.

Except for the auto-types, which are two-row machines, pickers may be of either one or two-row construction. All types and all makes, however, work on the same principle, major variations existing only in the husking arrangements.

Plate 159.

MECHANICAL HARVESTING OF MAIZE.—A two-row pull type picker completing a round. The maize at this stage is too dry for good husking. Note the broken stalks and the heavy weed growth.

[*Photo. G. Blom, Cairns.*

Briefly, two guides, one on either side, pass along the maize row. Gathering chains, situated within the inner edges of the guides, gather the maize stalks towards the snapping rolls.

The snapping rolls, two in number, are fitted between the guides. Special interlocking lugs encircle the rolls, which revolve towards each other on their upper edges, thus drawing the maize stalks through in a downward direction, snapping off the cobs, which, being thicker than the stalk, are unable to pass between the rolls.

Adjustments to meet varying thicknesses of stalk, size of cob, and wet and dry weather conditions, are provided for in the variable space between the rolls.

From the snapping rolls, cobs are passed, generally by an endless belt conveyor, to the husking machinery. Husking is accomplished on a set or sets of rollers, $2\frac{1}{2}$ to 3 inches in diameter, arranged in pairs and revolving, as in the case of the snapping rolls, towards one another at their upper edges and fitted with various forms of surface irregularities calculated to grip and tear the husk from the cob. In an alternative system the husking rolls are simply an extension of the snapping rolls and the cobs pass direct and in a straight line from the snapping rolls to the single pair of husking rolls.

Contact of the cobs with the rollers is maintained by an arrangement pressing the cobs against the rollers. This may be an endless belt

of slats revolving above the cobs, or alternatively several "paddles" actuated on an eccentric. Each system is cushioned on springs and is adjustable to the desired pressure.

Because of the necessity, under Tableland conditions, to hand select and reject Diplodia-infested cobs, clean husking is essential, so this section of the mechanism is of vital interest to the Tableland grower.

Machines with alternate rubber and steel rollers have so far shown a distinct superiority over the all-metal types and under favourable conditions have removed the husk covering from 90 per cent. of the cobs harvested. Rubbers, however, soon become smooth and worn and lose efficiency; consequently, it is necessary to renew or recover the rubber rolls after every 200 to 250 hours of work.

Most efficient husking is obtained before the plant is completely dry—that is, when the grain still contains 18-20 per cent. moisture. Late in the season, the husk becomes brittle and cannot be effectively torn from the cob. At this stage, the stalk is also brittle and breaks up under the action of the snapping rolls, resulting frequently in the loss of the cob.

With one man to operate the tractor and picker in the field and a second to remove and empty the trailers, a single row machine will harvest from 8 to 9 acres a day and a double row machine from 14 to 15

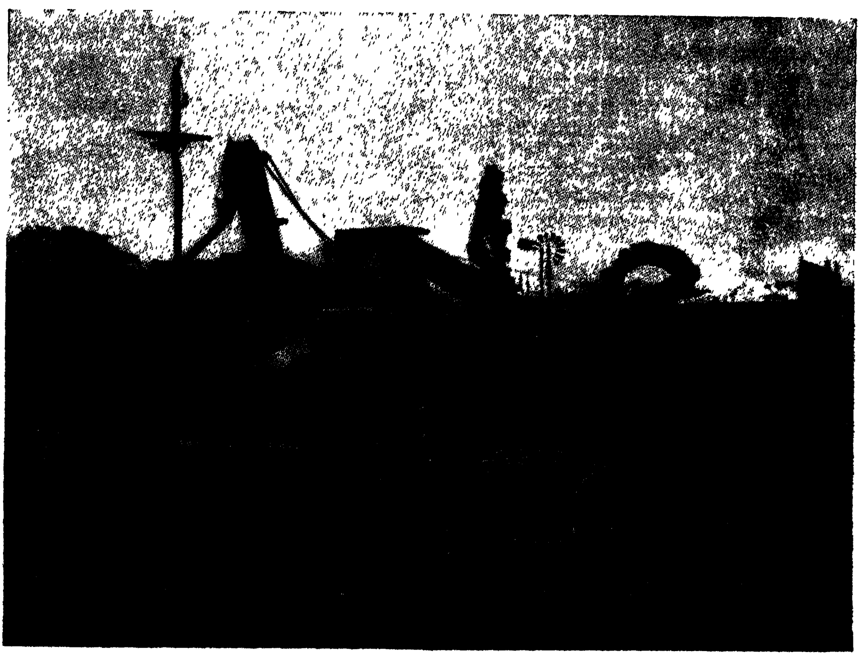

Plate 160.

SHELLING MAIZE IN THE FIELD.—The trailer is taken direct from the picker to the sheller and the shelled grain is loaded direct into open trucks for immediate delivery to the silos.

[Photo. G. Blom, Cairns.

acres. A single row picker can be successfully operated by a 16-horse-power tractor, but two-row machines require additional power. Cobs, as in the case of hand harvesting, are temporarily stored in barns awaiting cartage to the silos.

So far accurate costs for machine harvesting have not been determined. However, it has been established that the operating costs of a maize harvesting unit, consisting of a mechanical picker, a tractor to power the picker, a tractor to haul trailers to and from the barn, two trailers and a team of two men, are less than 12s. 6d. per acre for harvesting and storing maize on a farm. It is believed that, when capital costs are added to this figure, machines will still compete successfully with even highly-skilled manual picking. Although it does not appear that mechanical pickers can ever completely replace hand labour, it seems certain that they will remain a permanent feature of economic maize production on the Tableland.

SHELLING.

Except in a few isolated instances, all maize is shelled by the Board. The Board's machines are capable of shelling 20 tons of husked maize per hour and are worked as either stationary or mobile units, operating either at the silos or moving from farm to farm, whichever is the more economical or convenient.

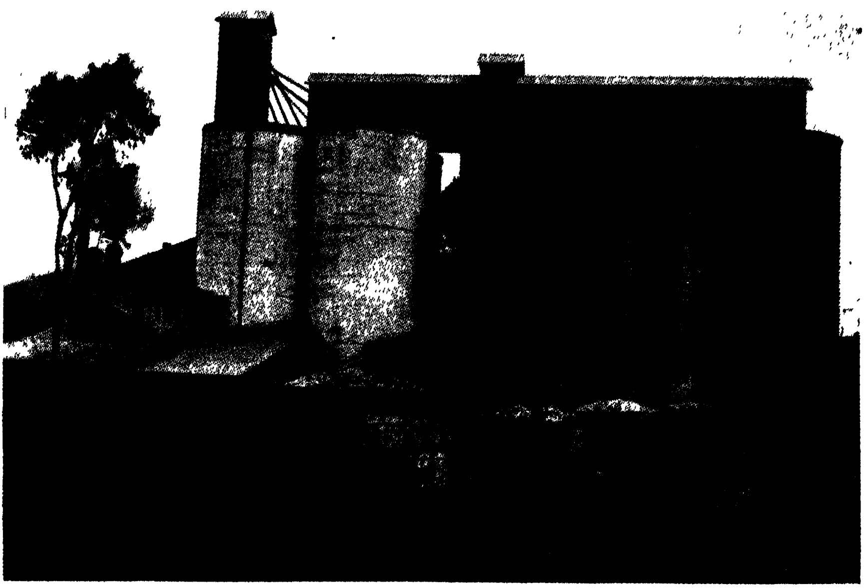

Plate 161.

DELIVERY OF MAIZE TO THE SILOS.—The motor trucks are ready to empty their loads of cobs into the scales at the Atherton silos.

[*Photo. G. Blom, Cairns.*

Costs are variable. Shelling at silos is estimated to cost only 1s. 3d. per ton, but the cost of movement greatly increases the cost of field or barn shelling. Normally field shellers (Plate 160) are used only during the peak of the harvest when the intake at the silos has to be maintained at its maximum.

CARTAGE.

Both cobs and shelled grain are carted from barns to silos in bulk (Plate 161). Cobs are loaded into motor lorries by powered elevators. Grain is loaded direct from the sheller. Lorries are boarded up to a height of approximately 5 feet above the floor of the vehicle and each lorry carries between 4 and 5 tons of cobs or grain per load.

Delivery to the silos is controlled and directed according to a pre-arranged itinerary for all lorries and so provides a continuous supply of grain to the silos without congestion as well as maintaining an equitable acceptance of grain from various growers as harvesting proceeds.

Attention is given to the condition of the maize in farmers' storage and care is exercised to obviate any loss by overheating, weevil infestation or other cause of damage.

Cartage rates are set by the Board and revised each season. Advances commensurate with rising costs are made from time to time but, as a result of organisation which minimises loss of time due to congestion at the silos and other causes, rates remain comparatively low.

Maize is also received in railway ballast trucks or hoppers, and conveniences at the silos conduct this grain through the same channels as when delivered by motor lorry.

RECEIVING AND HANDLING.

On delivery to the Board, loads, if in cob, are tipped into an underground conveyor which feeds the sheller; the shelled grain is then led to a sunken bucket type weighbridge for weighing, while the core or shelled cob passes along a conveyor to a receptacle for use as fuel in the steam boiler. Where field or farm shelled grain is being delivered, loads are tipped direct into the weighbridge through a grid at ground level provided for that purpose. While the maize is in the scales, samples are drawn off from each load by a standard spear type of sampler and set aside for moisture content and grading determinations.

All maize is accepted on a 14 per cent. moisture basis and any excess is deductible from a supplier's gross weight. Deductions are also made for dead grain and offal as indicated by the sample and penalties are imposed for any amount of dead grain exceeding 3 per cent. of the bulk load.

The weighed and sampled grain passes from the scales by underground conveyor and elevator to the separator or cleaning machine, which extracts dust, broken grains, other foreign matter, and as much as possible of the dead grain. Where it is necessary to do so—that is, when the grain has more than 14 per cent. moisture—excess moisture is extracted by a battery of dryers.

MAIZE DRYERS.

Briefly these dryers may be described as vertical cylinders 16 feet high and 8 feet in diameter with a steam jacket around the circumference and enclosing numerous vertical tubes, perforated at the base, through which the maize passes and around which steam is allowed to

circulate. A pressure fan delivers air at the base of the dryer and this, entering through the perforations at the base of the tubes, is forced through the falling grain and expelled at the top of the dryer.

When the dryers are in operation, maize is elevated to the top of the cylinder, where it is distributed to the numerous tubes and falls towards the base, the rate of fall being controlled by a shutter at the base of the dryers. Steam is injected to heat the falling columns of grain, and moisture thus liberated is carried off by the upward blast of air from the fans.

Adjustments to the rate of drying may be obtained firstly by the steam admitted into the jacket, which can be accurately controlled by the pressure valve; secondly by the fan blast, which is controlled by the air shutter on the fan; and thirdly by the rate of flow of the

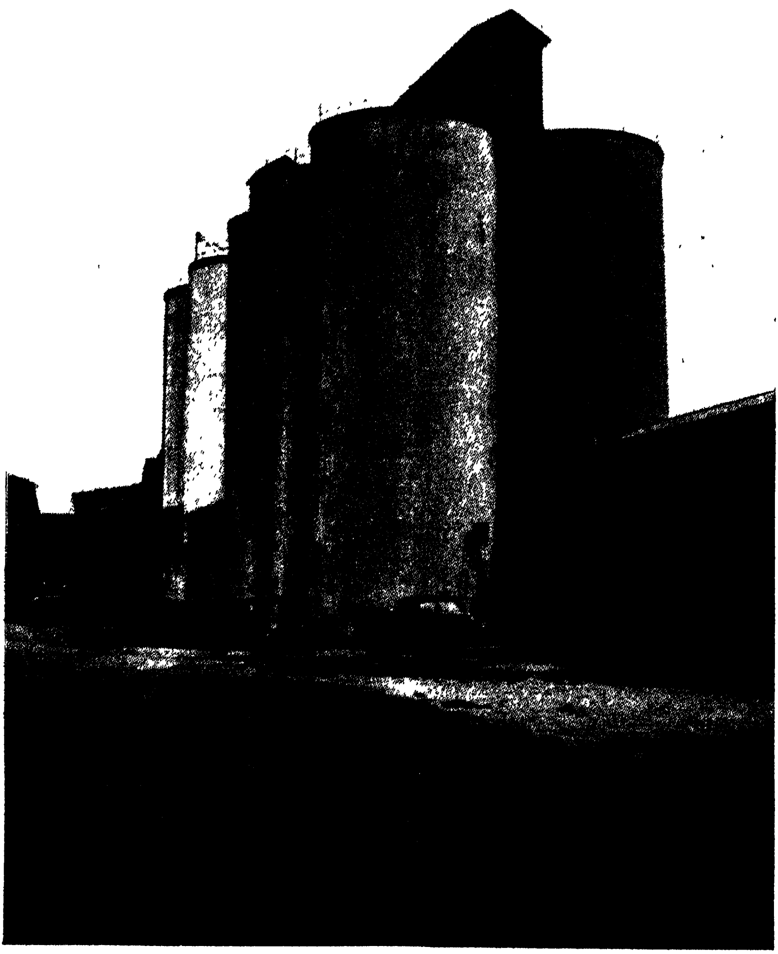

Plate 162.

THE MAIZE SILOS AT ATHERTON.

[Photo. G. Blom, Cairns.

maize itself, which is controlled by the exit shutter. Normally steam pressures are kept low to avoid overheating and damaging the maize, fan blast is kept high, and the rate of drying is regulated by the grain flow. All maize is reduced to a uniform 14 per cent. moisture content for storage.

The rate of drying, measured in terms of weight of maize treated per unit of time, varies according to the moisture percentage of the maize being dried and to the relative humidity of the atmosphere at the time. Thus, maize containing 20 per cent. moisture can be reduced to the 14 per cent. standard at the rate of 10 to 12 tons per hour. Maize at 18 per cent. moisture is reduced at the rate of 12 to 14 tons per hour;

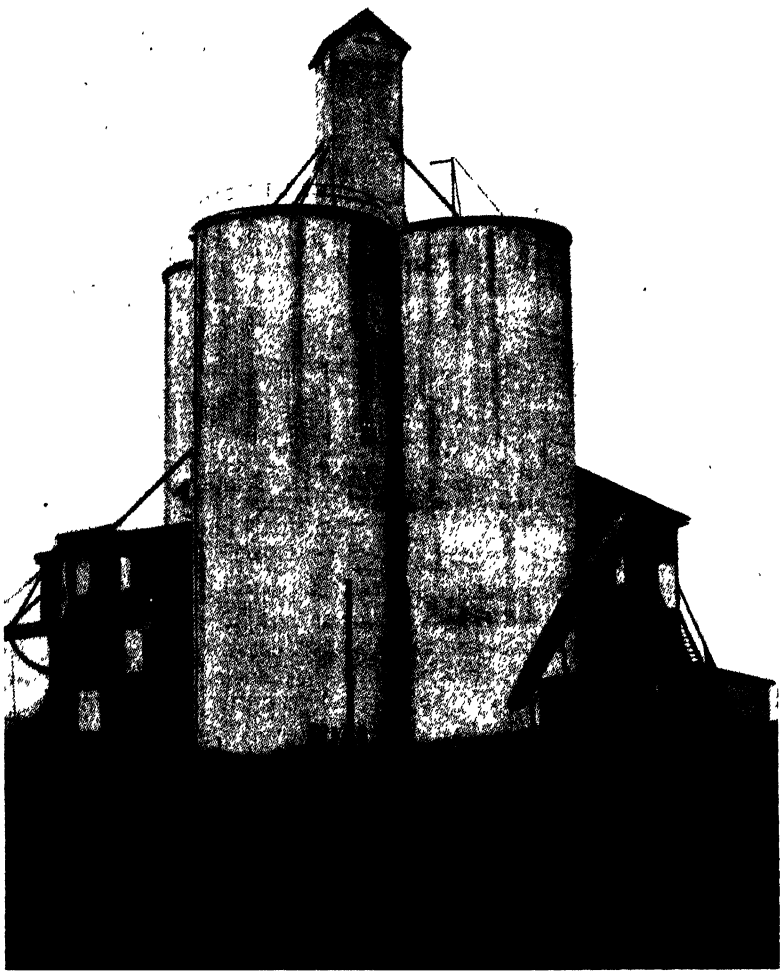

Plate 163.

THE MAIZE SILOS AT KAIRI.

[*Photo. G. Blom, Cairns.*

but at 16 per cent. moisture, because the water is increasingly less freely liberated as the moisture content nears 14 per cent., the rate for maize dried increases to only 14 or 16 tons per hour.

Maize at over 20 per cent. moisture is too immature and consequently unsatisfactory for drying. It has to be passed over the dryers twice to avoid scalding and damage and when dried retains the acid flavour and aroma associated with immaturity. In drying, too, the grain starch shrinks away from the outer skin and hull and the grain rapidly becomes pale in colour and stores poorly.

After leaving the dryers, grain is cooled in the "cooler," a large gauze enclosure, where the heated grain is exposed to a draft of cool air. On cooling it is elevated to the top of the silos, recleaned, and directed along a special endless belt to the particular bin desired.

SILO STORAGE.

The silos or bins (Plates 162 and 163) are cylindrical concrete structures 25 feet in diameter and 70 feet high. Each can hold 700 tons of well-packed dry maize, but some inconvenience is experienced in filling to this limit and practical working capacity is regarded as being between 600 and 650 tons.

Grain in the silos is drawn off when required at the base, whence it can, by a system of electrically driven conveyor belts and elevators, be directed to any point in the set-up—that is, into another silo, after being recleaned and if necessary cooled, to the automatic bagging-off scales, or to the mealing machines.

The main problems of bulk maize storage occur in the silos themselves. Maize at 14 per cent. moisture will generally store without fermenting or heating, but any accumulation of moisture resulting from uneven drying, humid or wet weather, a leak in the silo roof or walls, weevil infestation, or even a patch of maize containing a high percentage of diseased grain, will cause a rapid rise in temperature. If the position were not relieved mould could spoil the entire bin of 600 odd tons of grain.

Diseased and dead grains are the major sources of temperature rises in the silo and the introduction of this class of grain is avoided as far as possible. Particular precautions against introducing occasional loads of badly diseased maize into bins of sound maize are always taken, since these sources of "hot spots" require the turning of the whole silo of maize to correct the trouble occurring in the relatively small amount of bad corn.

The obvious objection is, of course, an economic one. A further important reason is that the turning mixes the bad grain still further through the sound grain. Again, dead grain breaks up gradually, and although much of it is eventually extracted by the separator even continued turning does not completely dispose of it.

All bins are fitted with tubes passing through the full depth of the silo, and by lowering a thermometer to various depths within these tubes the temperature throughout the bin's entire depth can be ascertained. Temperatures are read weekly at 7 feet depth intervals. At

the first sign of a sudden rise over 30 degrees C.,* the maize is turned—that is, it is emptied from the affected silo, recleaned, recooled and passed to another silo. Given favourable conditions of cool dry weather at the time, this operation can reduce the moisture content of "warm" maize by up to ½ per cent., and this is usually sufficient to obviate a recurrence of the trouble.

Well matured grain, field dried to 14 per cent. moisture or less and filled into silos on a cool dry day or night, will store at as low a temperature as 18 or 19 degrees C. These favourable conditions, however, seldom occur for a full bin. A very satisfactory temperature is 22 degrees C. and maize will store for long periods without much change at even 26 degrees C.

Damage to grain is occasioned when the temperature reaches 35 degrees C., and consequently when the rise in temperature exceeds 30 degrees C. turning has to commence.

At every filling of a silo and on every occasion on which maize is turned, moisture tests are taken at regular 20-minute intervals during the operation—that is, approximately for every 40 tons of maize.

A complete record of moisture tests and temperature readings is logged; from such records the history of all maize is known and subsequent temperature rises and danger points are accurately anticipated and speedily corrected. These records also constitute a most reliable guide to maize quality.

Temperature fluctuations are emphasised in the comparison of readings for silos when first filled from farmers' mixed deliveries and those in which the maize has been turned once. In the first instance, temperature readings are very irregular and unstable, whereas in the second instance temperatures are more even through the full depth of grain and remain constant for long periods.

The following extracts from the Board's log of temperatures illustrate the general pattern of the procedure of receiving and recooling maize for storage and also indicate the temperature changes which may take place in the process.

Extracts for four consecutive weeks for the 1947-48 crop toward the close of the receiving season are presented. The charts are for the Atherton nest of ten silos and for three interspaces, numbered 5, 8, and 11 in the tables, which are also used but which have a capacity of only 160 tons each.

Weevil infestation is controlled by carbon bisulphide. The fumigant is placed in trays set in the manholes in the top of the silos.

The rate of application of carbon bisulphide (2 gallons per bin) is below the recommended standard. During the early days of the silos larger quantities were used, but because of the objectionable nature of the fumigant and the difficulty of removing the odour from the maize

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*** Readings in degrees Centigrade can be converted into degrees Fahrenheit by multiplying by 9/5 and adding 32. For example, 30 degrees C. = $\frac{30 \times 9}{5}$ + 32 = 86 degrees F.**

TEMPERATURE CHART (IN DEGREES C.) FOR AUGUST 20, 1948.

Depth in Feet from Top of Silo.	Silo or Interspace Number.												
	1	2	3	4	5	6	7	8	9	10	11	12	13
7	..	..	..	..	..	22	22	..	22	..	..	..	..
14	..	..	24	..	..	24	22	..	21	..	18	18	..
21	..	..	28	..	..	26	22	..	20	..	19	18	..
28	..	..	24	..	..	27	23	..	24	..	19	18	..
35	25	..	27	30	..	24	22	..	21	..	18	20	..
42	32	26	29	29	..	25	21	..	20	..	18	20	..
49	31	26	29	28	..	24	22	..	24	20	18	22	19
56	30	29	24	23	..	25	22	..	23	21	20	23	19
63	24	26	22	24	..	24	23	..	22	21	20	23	18

Silos 1 to 4 contained maize direct from the grower and silos 6 to 13 (with the exception of interspace 8, which was empty) contained grain which had been turned and recoolcd. Attention is drawn to the low readings in interspace 11 and silo 12, which were filled during cool weather. Maize in silo 2 which heated suddenly on top was being turned to silo 13, but silo 1 rose suddenly and had to be turned in its stead. Silo 6 was marked for bagging-off because of the comparatively high readings at the 21-feet and 28-feet levels.

TEMPERATURE CHART (IN DEGREES C.) FOR AUGUST 27, 1948.

Depth in Feet from Top of Silo.	Silo or Interspace Number.												
	1	2	3	4	5	6	7	8	9	10	11	12	13
7	..	..	..	..	..	..	22	19	22	..	..	18	21
14	..	..	23	..	..	..	21	19	21	..	18	18	22
21	..	..	28	..	..	35	22	19	20	..	18	18	20
28	..	19	27	31	..	29	22	20	25	17	18	18	19
35	..	23	27	30	..	25	23	20	22	17	18	20	18
42	..	22	29	30	..	25	21	20	23	18	18	23	19
49	..	23	29	28	..	24	22	20	25	18	21	22	18
56	..	25	23	22	..	26	22	20	24	18	22	24	18
63	23	19	22	23	..	26	22	20	23	18	21	23	18

The principal changes from the previous week were that silo 2 had been emptied into silo 13 and was being refilled with incoming maize. Silo 1 has turned partly to silos 13 and 10 and the interspace 8, while silo 4 has commenced turning into silo 10. A quantity of maize was bagged off from silo 6, but a sudden rise at the 21-feet and 28-feet levels necessitated a temporary delay in bagging-off in order to cool and turn the "hot spot" into the interspace 5.

TEMPERATURE CHART (IN DEGREES C.) FOR SEPTEMBER 3, 1948.

Depth in Feet from Top of Silo.	Silo or Interspace Number.												
	1	2	3	4	5	6	7	8	9	10	11	12	13
7	25	..	..	..	18	..	21	20	23	20	..	18	21
14	20	..	..	..	19	..	21	19	21	21	18	18	23
21	20	..	..	..	19	..	22	20	21	20	18	19	21
28	20	..	..	..	18	..	22	19	28	18	19	19	20
35	21	25	..	..	18	..	22	20	22	18	18	21	18
42	19	24	19	..	19	..	22	20	27	18	18	22	18
49	21	26	17	..	19	24	22	20	25	18	21	22	19
56	22	26	19	30	21	26	22	20	24	18	23	23	19
63	22	27	21	26	21	27	22	20	23	18	22	22	18

By 3rd September silo 4 was nearly empty, but the process had to be stopped when silo 3 became hot and was emptied into silo 1. Silo 3 then commenced refilling from 2 and 4. The "hot spot" of silo 6 had been turned into interspace 5 and bagging off continued in silo 6. By this time deliveries from farmers had declined.

TEMPERATURE CHART (IN DEGREES C.) FOR SEPTEMBER 10, 1948.

Depth in Feet from Top of Silo.	Silo or Interspace Number.												
	1	2	3	4	5	6	7	8	9	10	11	12	13
7	26	..	21	..	..	..	22	21	..	20	..	18	23
14	20	..	23	..	..	..	22	20	..	21	18	18	24
21	20	..	22	..	..	18	22	20	..	21	19	21	23
28	21	25	19	..	..	18	23	20	..	19	19	22	21
35	22	24	19	..	..	21	24	20	..	18	19	23	19
42	20	22	22	..	..	20	23	20	..	19	19	23	19
49	21	22	18	..	..	22	23	21	..	18	23	23	20
56	23	22	19	..	25	21	23	20	..	18	25	24	19
63	22	18	22	..	25	21	23	20	..	19	23	23	18

By 10th September silo 2 had been emptied into 3 and silo 4 had been turned into 2. Silo 6 had been completely bagged and silo 9 turned into it. Interspace 5 had been bagged off for sale and partly refilled from deliveries, which had almost ceased by this time. All maize, with the exception of that in interspace 5, had been re-cooled for storage.

grain when the larger dosages were used, the amount of fumigant was gradually reduced by trial to the present dosage. It is claimed that at this strength insect infestation is kept at a low enough level for commercial purposes. After fumigation the maize is turned to remove any objectionable aroma from the grain and also because it is usual to find that a silo requiring fumigation to check insect infestation at the same time requires turning to correct a temperature rise.

Trials are in progress to determine whether benzene hexachloride preparations can be used to replace carbon bisulphide partly or wholly in silo fumigation.

MAIZE DISPOSAL.

As sales are contracted maize is bagged-off from the silos. Grain passes, after cleaning, direct to the automatic weighing machine. Bags are filled to a standard net weight of 149½ lb. (15 bags per ton), thus allowing rapid sewing. Under this system, six men—one operating the scale, three sewing and two loading—are capable of bagging-off and stacking into railway trucks 25 tons per hour or 5,000 bags per day. The greater bulk of the maize is disposed of by rail, and loading direct into railway trucks is assisted by chutes leading from the bagging platform. Road vehicles loading on the other side of the silos, and which cater for local trading only, are fed by hand trollies.

Maize is offered for sale as whole grain, as cracked (kibbled) grain, as meal, or incorporated in mixed stock foods.

CURRENT PROBLEMS OF BULK MAIZE STORAGE.

To accommodate the present rapid change from hand to machine picking which is taking place, new problems have presented themselves to the Maize Marketing Board.

The primary danger with mechanical picking lies in any inefficiency of the machine in removing the husk well enough to allow of a quick and efficient inspection of each individual cob, in which case dead grain

could and does find its way past the shellers to the silos. If not removed, this inferior grain will reduce the general quality of stocks and provide all the problems attendant upon the storage of dead grain.

To obviate this problem, a new separator has been designed and inserted into the line of grain travel on the top of the silos. Dead grain has been found to give up moisture more readily than sound grain in the dryers and thus immediately following drying such grain can be and is more readily "lifted" from the separator riddles. The successful separation of dead from sound grain would obviate the need for manual inspection of his crop by the grower before delivery and would materially reduce his handling costs.

Owing to the risk of fire associated with the shelling at the silo of maize carrying a fairly high percentage of husk covering, such crops are best shelled in the field. Alternatively, some provision must be made at the silos to trap and destroy the husks immediately following shelling. The Board hopes to accomplish this by using a blast incinerator and is making preparation for the erection of such a safety measure.

Picking machines work most efficiently in "wet" crops and may deliver much grain of a high and probably uneven moisture content. This will complicate handling, since it will test the capacity of the Board to dry the maize and probably, by creating an unevenness in the moisture content of concurrent deliveries from various farms, intensifying the drying problem. To meet the situation, either the Board will need to instal additional dryers or farmers will have to build additional barn space of a type in which the cobs will not heat. Suitable storage is provided by slatted V-shaped cribs, which will allow of a complete circulation of air around the stack of cobs. This type of storage structure obviates fermentation of the grain and allows a gradual loss of moisture.

The unrestricted use of mechanical harvesters could overload silo intake, cartage facilities, and even farm barn capacity as the position stands at present. The remedy adopted is to arrange that all pickers work to an itinerary mutually agreed upon by representatives of the Board and machine operators so that the rate of shelling and cartage can be adjusted according to the various capacities and limitations of all facilities.

No problems that can be seen now are insurmountable, but the solution of all of them may take some time. The efficient procedure in the handling and storage of maize on the Atherton Tableland based on manual picking has been developed over a long period of trial and error, often in the face of many difficulties. To meet the new situation created by the rapid increase in mechanical harvesting, modifications and changes will certainly be necessary, but judging by the success of past performances there is no doubt that a satisfactory system of handling and storing maize in conjunction with mechanical harvesting will be achieved eventually by the Atherton Tableland Maize Marketing Board.

A Mechanical Arrowroot Harvester.

APART from its widespread use as a fodder crop in coastal districts, the arrowroot plant is grown for flour extraction on about 500 acres on the south coast.

Hand digging of the crop for flour purposes is laborious work, the estimated labour requirement being one man per ton per day.

A Brisbane inventor, Mr. G. H. Burke, has devised a machine of original design for the harvesting of arrowroot bulbs. This machine is illustrated in Plates 164-166. The essential parts of the harvester are as follows:—

(1) A heavy flattish and somewhat pointed share or blade which can be regulated for depth and which is adjusted so as to pass under the crowns of the plants.

(2) A small, slightly inclined conveyor which carries the material lifted by the blade into a cleaning drum.

(3) A cylindrical wire cleaning drum fitted internally with iron vanes and having a central spindle carrying agitators.

(4) An endless belt elevator delivering into a chute or slipper.

The harvester is driven by a tractor power take-off attachment fitted with a self-operating clutch.

The operation of the machine is quite simple. The digging elevator lifts the bulbs, which are conveyed to the revolving drum or rumbler, which cleans the stool and breaks it into individual bulbs. The loading elevator carries the bulbs upwards and empties them on to the slipper, which delivers into a truck travelling in the same direction as the machine.

With one man driving the tractor and another attending the harvester, an output of 5 tons per hour could probably be maintained.

In trial runs the harvester has delivered the bulbs into the motor truck in a satisfactory condition, only slight bruising occurring in comparison with the appreciable amount of crushing which results from hoe digging.

The use of a mechanical harvester of this type would necessitate greater speed in the processing of the bulbs and particularly in the drying of the flour. This aspect is now under consideration.

Patents covering the harvester and blade have been applied for by Mr. Burke.

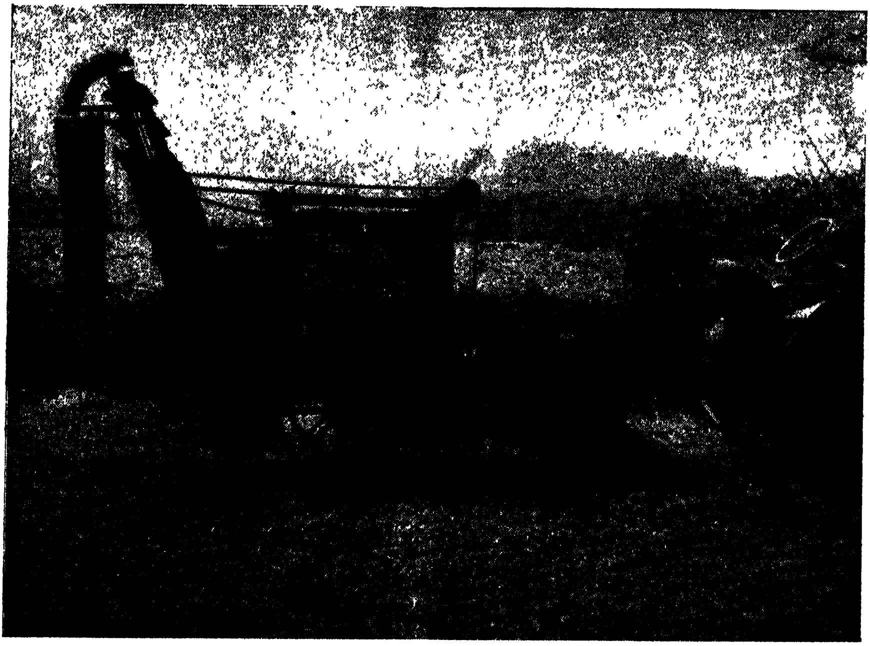


Plate 164.
BURKE'S ARROWROOT HARVESTER.—General view, showing the digging elevator, the revolving drum, the loading elevator and the slipper in the travelling position.

Plate 165.
BURKE'S ARROWROOT HARVESTER.—View showing the loading elevator and the slipper in the travelling position.

Plate 166.
BURKE'S ARROWROOT HARVESTER.—Showing the slipper in position for loading.

WORLD FOOD SUPPLY IMPROVES.

The Food and Agriculture Organisation of the United Nations, in a report on the world food situation, states that world food production for the year ending 30th June, 1949, will be materially higher than in 1947-48.

Stating that agricultural crop production for direct human consumption is "about back to pre-war levels," the report points out, however, that total food available does not reach the pre-war figures because animal products are still considerably lower than they were before the war.

The increased crop production is attributed primarily to exceptionally favourable seasonal conditions in Europe and North America in 1948, in contrast to the unusually bad weather and low yields in Europe in 1947.

This increased crop production, F.A.O. states, means that aggregate supplies of both food and feed grains are substantially larger than last year's, but reduced livestock numbers (due in Europe to the feed shortage the previous year and in America to competitive alternatives and comparative price factors) have caused a decline in meat and other animal products supplies this year below the 1947-48 level. In the second half of 1949, however, a rapid increase in poultry and pig products is expected. Milk production, also, has already shown some response to better pastures and feed supplies, but because of the time required to build up dairy herds this progress must continue to be slow.

Overall, however, per capita world supplies of food in 1948-49 are only around 90 per cent. of pre-war supplies per capita. One important reason for this is the fact that world population has increased by about 10 per cent. since before the war.

PLANT PROTECTION

Tomato Diseases and their Control.

J. E. C. ABERDEEN, (formerly Pathologist, Science Branch).

THE tomato plant is subject to attack by a large number of diseases, many of which may cause substantial losses to growers if adequate precautions are not taken to deal with them. Preventive measures should be adopted as far as possible, because they are generally cheaper and more satisfactory than control measures applied to crops which are already infected. The programme of disease prevention and control should be planned well in advance of the planting of the crop, since it involves consideration of the following matters:—

(1) The purchase of disease-free seed.

(2) The planting of only those varieties which possess some degree of resistance to Fusarium wilt.

(3) The careful establishment of the seed-bed.

(4) The choice of the position of the field planting, only after consideration of a suitable rotation.

(5) Ensuring that adequate supplies of fungicides and insecticides are ready for immediate application.

(6) Ensuring that the spray apparatus is working efficiently.

KEY TO AID THE IDENTIFICATION OF TOMATO DISEASES IN SEED-BED AND FIELD.

The following key should help in the identification of the major tomato diseases, apart from nutritional disorders. Any determination of a disease made by using this key, however, must be checked by referring to the detailed descriptions of the symptoms given later under the heading of that disease. If the disease does not appear to correspond with any of those described, further advice should be obtained from the Department of Agriculture and Stock.

IN THE SEED-BED:

1. Seedling stem shrivels at ground level, and falls to the ground ... **Damping-off.**

2. Stem shows a dark-brown to black spot near soil level; growing tip often purplish in colour ... **Target Spot.**

3. Leaves show small, dark spots ... **Target Spot, Bacterial Spot, or Septoria Leaf Spot.**

4. Leaves and stem show relatively large dark, rotted areas ... **Irish Blight.**

5. Entire seedling stunted and purplish; no disease apparent on leaves, stem, or roots ... **Faulty Nutrition or Virus Disease.**

6. Seedling stunted; growing tip producing thickened distorted leaves; stem shows a characteristic bronze-green colour and reduced number of hairs ... **Tomato Mite.**

IN THE FIELD:

1. Entire plant wilted—

(a) Wilting very rapid—sometimes in a few hours—suggesting plant severed from root system; no yellow leaves. Stem at soil level may or may not show a light-brown discolouration of woody tissues **Bacterial Wilt.**

(b) Wilting very slow—sometimes takes weeks; older leaves show distinct yellow colour; affected leaves break off easily from stem. Stem and leafstalks show light-brown to dark-brown streaks under bark in hard, woody tissue **Fusarium Wilt** (in summer), or **Verticillium Wilt** (in winter).

(c) Some stems show splitting and rotting of internal tissue with mealy appearance; affected leaves do not break away from stem readily; leaflets on one side of leaf usually affected first (see also fruit symptoms) **Bacterial Canker.**

2. Entire plant stunted—

(a) Bronze markings on young leaves; these curved downwards more than normally . **Spotted or Bronze Wilt.**

(b) Young leaves show light and green markings and tendency to crinkle . **Mosaic.**

(c) Young shoots swollen and distorted, with last-formed flower buds standing erect; purplish colouration throughout tips **Big Bud.**

(d) Young leaves malformed, with leaflets very spindly and fernlike **Fern Leaf.**

(e) Irregular, greyish-black, slightly-sunken streaks on stem or leaves .. .. **Streak.**

(f) Young shoots show intense purplish colouration **Faulty Nutrition, Excessively Cold Temperature, Virus Disease, Irish Blight,** or **Target Spot** (attacking stem).

3. Leaves and stems—

(a) Small spots about ⅛ inch in diameter, with grey centres and small black pin-point dots. Leaves at base usually affected first **Septoria Leaf Spot.**

(b) Dark-brown spots, up to ½ inch in diameter—sometimes larger on stem—with sharp margins and often with concentric ringed appearance. Basal leaves usually affected first. By far the commonest leaf spot . . . . **Target Spot.**

(c) Large, dark-brown lesions often involving entire leaflet. These have the appearance of a wet rot in humid weather but are papery if atmosphere is dry. May show first on any part of plant . **Irish Blight.**

(d) Lesions uniformly small, rarely greater than ⅛ inch in diameter, dark-brown in colour . **Bacterial Canker** or **Bacterial Spot.**

(e) One leaf, or part thereof, shows decided wilt (see also fruit symptoms) .. .. **Bacterial Canker.**

(f) Older leaves yellow without any obvious spotting; with or without wilting of tips ... .. **Fusarium Wilt.**

(g) Large yellow indefinite lesions on upper surface of leaf, accompanied by a characteristic velvety dark layer of fungus under leaf. Only severe in wet northern regions of Queensland **Leaf Mould.**

4. Fruit—

(a) Dark, sunken spot present on flower end of fruit **Blossom-end Rot.**

(b) Mottled, brown markings covering large proportion of fruit surface; spread very rapidly (see also leaf and stem symptoms) ... . **Irish Blight.**

(c) Very dark spots, sunken and velvety, commonly up to ¾ inch in diameter, usually originating from stalk attachment, growth-cracks or other injury .... **Target Spot** and other **Alternaria Rots.**

(d) Small spots 1/16 to ⅛ inch in diameter, usually with light halo around margin .... **Bacterial Canker.**

(e) Small spots 1/16 to ⅛ inch in diameter, often raised and scab-like; no halo **Bacterial Spot.**

(f) Large tough white spot on side facing sun **Sunburn.**

(g) Blotchy ripening **Mosaic,** or other **Virus Disease, Shade Spot,** or other **Physiological Disorder.**

(h) Fruits generally dwarfed, mis-shapen and hard **Virus.**

(i) Fruit completely broken down by watery rot **Bacterial or Fungous Rot** following insect or other injury.

(j) Fruit angular, with large air spaces inside **Puffiness**

(k) Blossom end of fruit mis-shapen **Catface.**

(l) Reduced fruit set with plant otherwise normal **Blossom Drop.**

Plate 167.

TARGET SPOT ON FOLIAGE.—**Inset shows concentric rings more highly magnified.**

TARGET SPOT.

This disease is very common both in the seed-beds and on the plants in the field. The seedlings do not always show obvious symptoms, as they may be attacked only on the stem at ground level and exhibit merely a hard, stunted appearance. A period of warm, moist weather following infection may soon cause the death of such infected plants. If the infection is unnoticed and the seedlings are planted out into the field, the stem lesion usually develops to a dry shrunken area, which may cause retardation of the growth of the transplants and result in a girdling of the stem leading to death of the affected plants, or leave the plants so weakened that they readily snap in the wind. This symptom is usually known as "collar rot." A plant may recover, if it has been transplanted sufficiently deeply, by developing new roots above the target spot lesion.

Plate 168.

TARGET SPOT ON FRUIT.

Leaves, stems, and fruit may be affected on plants in the field, but the older leaves usually show the symptoms first. Dark brown spots, commonly $\frac{1}{8}$ to $\frac{1}{4}$ inch in diameter but up to $\frac{1}{2}$ inch under favourable conditions and with definite margins, are produced on leaves and stems. These spots may be marked by the concentric rings (Plate 167) from which the common name of the disease is derived. They may also have a yellow margin. The fruit lesions are in the form of black to dark-brown oval to round spots, which usually occur immediately on the edge of the stem scar (Plate 168) but may be also scattered about the fruit. In the former case, they may often be associated with a growth-crack, but at other times the disease appears to have attacked the fruit stalk first and subsequently entered the fruit. The fungus does not grow readily in green fruit, so that a mature green fruit which is infected, although not showing any spots when forwarded to the market, may develop the disease as it commences to colour.

This disease is caused by one particular fungus (*Alternaria solani*), but when causing fruit rots it may have associated with it several closely-related fungi which help to extend the damage. All of these fungi are far more resistant to dry weather conditions than is the fungus causing Irish blight, and they appear to require very little moisture and wind movement for their development and spread. Also, the target spot fungus prefers warm temperatures, so that in south-eastern Queensland the autumn and spring are the seasons most likely to provide conditions favourable to epidemics, though the disease may be present to some extent throughout the year. Observations indicate that the disease advances more rapidly when the plant is carrying its maximum load of fruit, and that if plants are backward in any way they are more readily attacked. The available evidence suggests that the target spot fungus is readily carried over in the soil from season to season.

Target spot is present throughout all the tomato-growing areas of Queensland, and probably causes a greater aggregate loss than any other tomato disease. The slower and less spectacular spread than in Irish blight results in greater neglect by the growers and treatment is often commenced too late to do any appreciable good.

Control.

Copper sprays and dusts are the most efficient fungicides available for the control of this disease. The usual spray strength for field use is that given by 4-2-40 Bordeaux mixture; commercial copper compounds should be used at the equivalent strength of copper. With a crop like tomatoes, where rapid growth necessitates frequent applications of the fungicide in order to maintain a covering on the growing tips, it is very likely that a weaker strength of Bordeaux would exercise economic control. In considering dusts, however, it is not recommended that anything less than a strength of 7 per cent. copper should be used, to be increased to 10 per cent. if conditions are favourable to the spread of the disease.

The degree of control obtained by the use of fungicides is not, however, always completely satisfactory. Hence, the destruction of the diseased crop by burning at the end of the season is more essential for the protection of the next crop than in the case of Irish blight, and the adoption of a three years' rotation is another worth-while precaution.

Furthermore, great care should be exercised in the selection of the seed-bed site, and the precautions given later regarding seed-bed management should be followed carefully. Also, the plants should not be held in the bed longer than necessary if early signs of the disease are present.

Bordeaux mixture or a copper spray shoud be reduced to a 2-1-40 strength when used in the seed-bed and not applied within two days of transplanting, as the loss in transplanting may be increased considerably if conditions are dry at the time. If collar rot is regularly causing trouble in the seed-beds, a solution at the same strength as for application to the plant may be watered directly on the surface of the soil after planting the seed.

IRISH BLIGHT.

The first evidence of the presence of this disease is usually in the form of extensive dark-brown to black lesions on the stems and leaves (Plate 169). In moist weather the leaf lesions have the appearance of a

wet rot and may even show a white downy growth on the lower surfaces of the leaves, but when dry conditions prevail the lesions are dry and papery. The fruit is readily attacked in all stages of development, a large mottled-brown lesion with indefinite margins usually covering at least one-fourth of the fruit surface being produced (Plate 170). A

Plate 169.
IRISH BLIGHT ON STEM.

minor symptom of Irish blight is an intense purple discolouration of an individual stem, apparently due to interference with the food supply to that stem caused by girdling. Where no control is exercised, an apparently vigorously growing crop of tomatoes may be reduced to a mass of blackened leaves and stems within a few days, somewhat similar to the result of frosting.

Where conditions favour its development, Irish blight is the most destructive and spectacular of the tomato diseases. It is very closely related to the Irish blight of the potato, and under certain conditions the disease may readily pass from one crop to the other. In Queensland its importance varies from one district to another. It is uncommon in the Stanthorpe district, and when it does occur there, it is not until the end of the season, i.e., during April and May. In the Brisbane-Redland Bay area it may attack plants at any time from April to October, depending on the local weather conditions. The disease is less common

in the Yarwun-Rockhampton area, although it does occur there occasionally during the winter months. In the Bowen area it is of very rare occurrence. This variation in severity of incidence can be correlated with the temperatures and humidities of the growing season in each area.

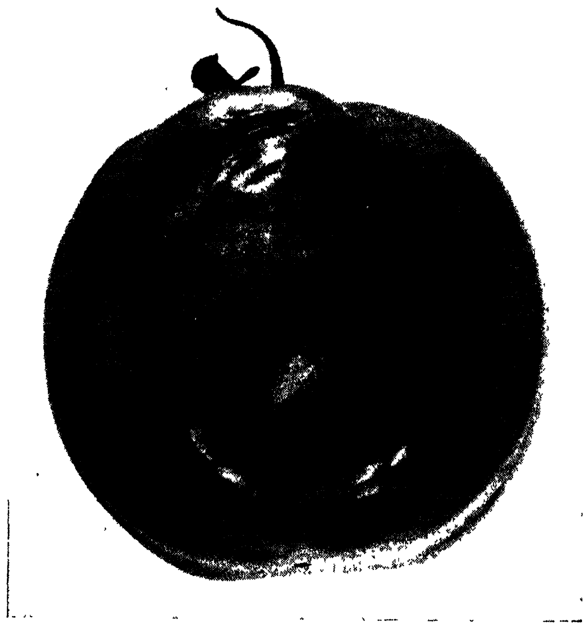


Plate 170.
IRISH BLIGHT ON FRUIT.

Irish blight is caused by a fungus (*Phytophthora infestans*) which grows very readily in cool, moist weather. As indicated above, the disease appears only in the cooler months, during which time it may become epidemic only when favoured by continued showery conditions and overcast skies. Heavy dews also favour its spread. The extremely rapid development of the disease, which sometimes occurs, is usually brought about, however, by a succession of sharp, cold snaps, as the causal fungus, under these conditions, can reproduce itself even more rapidly than when the weather is uniformly cool and moist. If the temperature rises appreciably, or dry weather appears, the spread of the disease ceases immediately. As Queensland winters are normally dry, epidemics of Irish blight are not common in this State. The memory of one such epidemic is, however, sufficient to keep a grower conscious of the possibility of a recurrence for a number of years.

Control.

This disease can be controlled by the use of copper sprays or dusts. Owing to the rapidity with which the disease can spread, the usual practice is to commence application of a fungicide in the seed-bed without waiting for the disease to appear, and to continue treatment throughout that portion of the year in which climatic conditions favour-

able to the spread of disease may occur. Normally, the interval between applications is 7 to 10 days; this period may need to be shortened if climatic conditions are unusually favourable to the development of Irish blight, whereas during prolonged dry spells it may be increased. As for target spot, it is not advisable to reduce the strength of a dust below 7 per cent. copper. Sprays weaker than the standard 4-2-40 Bordeaux mixture could possibly be used, but thoroughness of application must never be neglected.

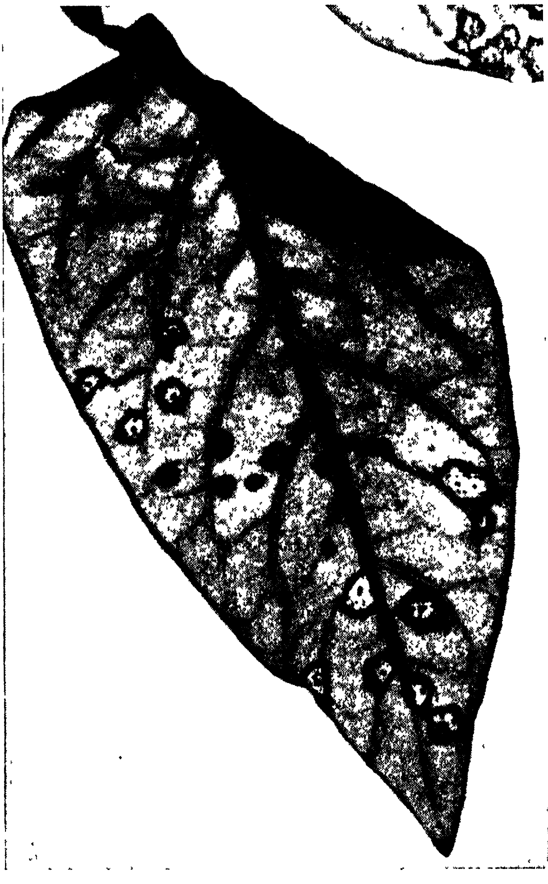


Plate 171.
SEPTORIA LEAF SPOT ON LEAF.

It must be noted that tomatoes may be packed in apparently good condition and develop the symptoms of Irish blight while in transit to, or on, the market. Hence, if the grower has Irish blight in his crop it is advisable for him to hold the fruit for three or four days before packing.

SEPTORIA LEAF SPOT.

The fungus (*Septoria lycopersici*) which causes this disease produces small brown spots about $\frac{1}{8}$ inch in diameter, scattered over the lower leaves of the plant. While the margins of the spots remain brown, the centre develops a light-grey colour and is characteristically studded

with a number of small black pin-points which are the tops of the minute, flask-shaped spore receptacles belonging to the fungus (Plate 171). The lesions are usually much smaller than those of target spot, but the early stages could readily be confused with bacterial spot. Yellowing of the leaf takes place around the spots and gradually spreads until the leaf dries out and withers. The lower leaves are killed from the bottom up, and a scalding of the fruit thus exposed to the sun may result.

Septoria leaf spot occurs in all of Queensland's tomato-growing areas, but is not nearly as important as Irish blight or target spot. This disease is most serious in the warmer months of the year.

Control.

The plants in the seed-bed and the field should be sprayed or dusted with copper mixtures as recommended for other leaf diseases, and all tomato refuse should be collected and burned as soon as the crop is off. This disease is seldom present unless in association with either Irish blight or target spot, so rarely requires special treatment. As Septoria leaf spot seriously affects plants which are not growing vigorously as a result of inadequate fertilizer application or insufficient cultivation, attention to these aspects of the tomato crop's requirements helps to lessen the incidence of the disease.

LEAF MOULD.

An important point in diagnosing this disease is that it is only likely to occur seriously in the very high rainfall districts of Queensland, that is, north and south of Innisfail. A characteristic symptom in this area is the premature death of the older leaves, leaving the plant with a ragged appearance somewhat similar to the result of defoliation by target spot. Another characteristic is the appearance on the lower surface of the leaf of a velvety dark growth, which is the causal fungus. In the earlier stages of the attack the leaves show indefinite yellow lesions on the top surface. Infection of the fruit is unusual, but the blossoms may be attacked and destroyed.

The disease is caused by a specific fungus (*Cladosporium fulvum*) and the essential factor for its spread is a very high humidity. While the disease has been recorded as far south as Brisbane, the only area that can fulfil the necessary conditions for a period long enough to encourage an epidemic is from Ingham to Cairns. Here leaf mould often surpasses target spot in importance. While the disease is present in most other countries, it is usually troublesome only in glasshouses.

Control.

Within glasshouses great stress is laid on the importance of controlling temperature and humidity. That is to say, temperature should be kept below 70 deg. Fahrenheit and relative humidity below 70 per cent., and ample ventilation should be provided. Control of these conditions in a field crop is usually out of the question. However, it will be seen that areas well protected from winds are the most likely to be affected, as high relative humidities develop more readily in still atmospheres. The breeding of tomatoes resistant to leaf mould has been successful in some areas, but owing to the different strains of fungus

no one variety is successful everywhere. For example, Vetomold, one of the most useful under American conditions, is a relative failure in Queensland.

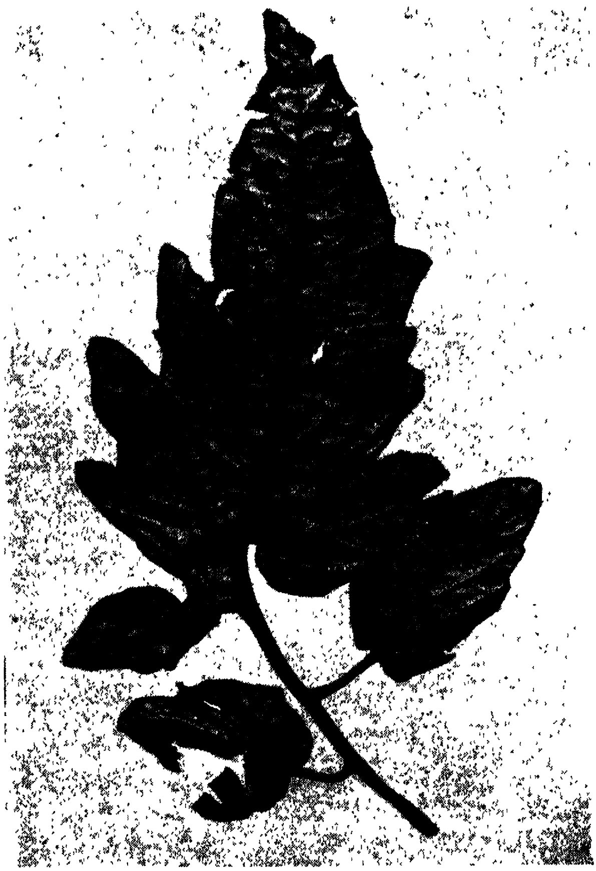


Plate 172.
BACTERIAL SPOT ON FOLIAGE.

Salicylanilide sprays have had some success in New Zealand and English glasshouses and may be useful here. In Queensland, however, copper sprays at a strength equivalent to 4-2-40 Bordeaux mixture are the most widely used. While these are not particularly effective, general experience indicates that the measure of control justifies the expense.

BACTERIAL SPOT.

The bacterium (*Xanthomonas vesicatoria*) responsible for this disease attacks the leaves, stems and fruits. On the leaves (Plate 172) and stems (Plate 173) the disease appears as small brown spots similar to the early stages of Septoria leaf spot and target spot. They are differentiated from the former in that they do not develop the grey centres and pin-point fruiting bodies, and from the latter in that they remain comparatively small and do not develop concentric rings. Also,

if the bacterial spots are examined from the lower surface of the leaf, it will be found that many of them have a greasy surface. In addition to attacking leaves and stems, the disease forms small dark greasy spots on the flower hands which cause a considerable loss due to flower drop.

Plate 173.

BACTERIAL SPOT ON STEM.

On the fruit, bacterial spot appears as a small black raised scab-like spot (Plate 174) which may increase in size to approximately $\frac{1}{8}$ inch in diameter. When approaching the maximum size, however, the centres become slightly sunken. If the spotting is severe a number of spots will sometimes coalesce, forming a more extensive area. The size of the individual spot depends on the amount of growth that the fruit makes after it is infected, and does not increase after the fruit has matured. The fruit cannot be infected after a certain stage of maturity has been reached, which appears to correspond with the disappearance of the hairs from the fruit.

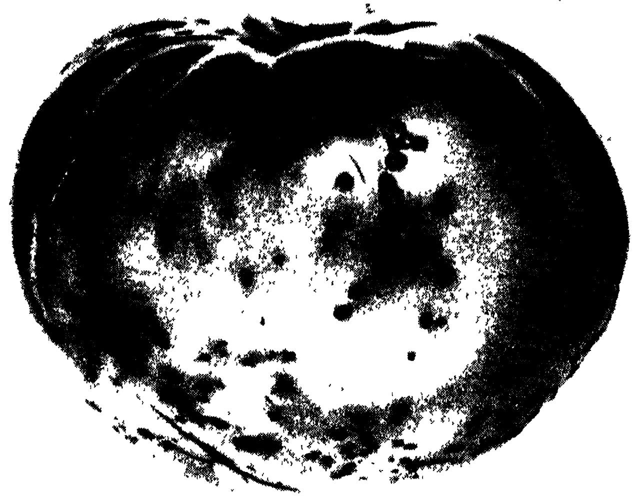


Plate 174.
BACTERIAL SPOT ON FRUIT.

This disease differs from bacterial canker in that the fruit spot has no coloured halo and it causes no wilting of the plant. It may, however, cause extensive defoliation. The fruit spot does not penetrate past the tissue immediately under the skin and if extensive rotting occurs it is due to other organisms entering the bacterial spot injury. No new spots develop in storage or in transit.

Late summer and autumn appear to be the most favourable periods for development of this disease, probably because rain is the main factor in its spread. Wind-blown rain followed by drizzly overcast weather create ideal conditions, but normally they are of brief duration.

The disease is widespread throughout the older tomato-growing areas and has caused considerable losses within the last few years. The damage on the fruit is usually noticed first.

Control.

The man sources of infection with bacterial spot appear to lie in the seed and in the soil, and the subsequent spread by handling the plants does not seem to be of the same consequence as in the case of bacterial canker. Hence, the precautions to be observed in seed selection and treatment must be emphasized as being of primary importance. Seed contamination is usually confined to the outside of the seed, so routine treatment with corrosive sublimate, copper oxychloride, or one of the mercurial seed dressings is definitely recommended. The general precautions in selection and treatment of the seed-bed, as discussed later, are also strongly recommended.

There is evidence that the application of copper sprays sometimes checks bacterial spot, but, if conditions are favourable to the spread of the disease, their use is generally of little benefit. On the other hand, crop rotation is of definite value in dealing with this disease.

BACTERIAL CANKER.

As bacterial canker is very easily spread from plant to plant by handling, especially in pruning a trellised or staked crop, it is important to be able to recognize the early symptoms of the disease. In a young infected plant one leaf, or perhaps only the leaflets on one side of a leaf, droops and wilts, while the remainder of the plant looks quite normal and vigorous. Following this preliminary wilting, there appears a die-back of the growing tip (Plate 175), and this is accompanied by a splitting of the stem.

The wilting of the leaflets on one side of the leaf, mentioned for the young plant, is also characteristic of the disease in the older plant. If an affected leaf on such a plant is broken or cut off, a brown discoloration of the tissues can be observed on the exposed area of the stem. On peeling away the surface layer of the stem just over this discoloured portion, the tissues are seen to have a mealy appearance. This discoloration advances into the inner portion of the stems as the disease progresses. In the later stages of the disease the stems of an affected plant may split and produce the cankers from which its name is derived.

Plate 175.

BACTERIAL CANKER ON YOUNG PLANT.—Leaf on left shows wilting of leaflets on one side only.

The leaf spots are usually round and very small, and not particularly characteristic, but the fruit spots generally have a white margin with a split in the centre and are therefore more characteristic and are suggestive of another name sometimes given to this trouble—bird's-eye spot (Plate 176). The spots are rarely over $\frac{1}{8}$ inch in diameter, and are not raised as is often the case with bacterial spot.

Plate 176.
BACTERIAL CANKER ON FRUIT.

Several other tomato diseases display symptoms which are similar to those produced by bacterial canker; for example, the one-sided wilt of the early stages of bacterial canker occurs at times in bacterial wilt and may also be caused by a stem-boring caterpillar. In addition to bacterial wilt, bacterial canker may be confused with Fusarium wilt. However, there is usually some distinguishing characteristic by which the diseases may be separated; for example, the golden yellow discoloration of Fusarium wilt is not found in bacterial canker, and the lower leaves do not break off so easily as is the case when Fusarium wilt is the cause of the trouble. Again, the mealy discoloration of the internal tissues of the stem which occurs in bacterial canker extends right into the pith, whereas in the case of Fusarium wilt and bacterial wilt the discoloration is confined to the water-conducting tissue, which presents a woody appearance.

Bacterial canker, as the name implies, is caused by a species of bacterium (*Corynebacterium michiganense*). The disease develops most rapidly in the early autumn and spring months, but crops affected in the early autumn will readily carry the disease into the winter. The

rate at which bacterial canker may spread in an affected crop is accelerated by the onset of rain, but it is not so strikingly dependent on rain as is bacterial spot.

Although the disease originally enters the crop through the medium of infected seed, its subsequent spread takes place either by the handling of the plants in pruning or other operations or, after the stems crack, by the splashing of the plants with bacteria in raindrops. Bacteria are present in large numbers in the stem cracks, and, if splashed on to the leaves and fruit by rain, extensive spotting will develop.

The only important tomato-growing area in Queensland from which bacterial canker has not been recorded is the Bowen district. This does not mean that it is not present there, however, because it could remain undetected for a considerable time in crops growing unpruned on the ground. So long as care is exercised in seed selection and treatment, it is unlikely that canker will affect a whole district to the extent that Irish blight may in a season which is favourable to its development. However, it can be disastrous for the individual grower, especially if he is trellising or staking the crop and has made several prunings before discovering the presence of the disease.

Control.

One of the most essential points in dealing with this disease is to obtain, if it is at all possible to do so, seed from a disease-free source. A grower who saves his own seed should take special precautions against bacterial canker infection, one of the most important of which is to allow the seed and pulp to ferment for three to six days without adding any water. The formation of acids in the fermenting pulp kills any bacterial organisms which may be present in the seed and in the pulp. However, as the type of fermentation may vary with different conditions, it is recommended that the seed be dried after cleaning and then treated in a corrosive sublimate solution according to the directions given later. Seed from an unknown source should also receive this treatment. Seed treatments with acetic acid and hot water may also be used. In spite of the seed treatments, however, the main emphasis must always be on disease-free seed.

Before the pruning of a tomato crop is commenced an experienced person should check through the crop and mark all plants suspected of being infected with bacterial canker. If more than 5 per cent. of the plants are so affected it is advisable to leave the crop unpruned on the ground, thus reducing handling to a minimum. The hands should be washed very thoroughly in soap and water after working with any diseased plants, and any material which will be used again next season (such as stakes) should be sprayed with 2 per cent. formalin and immediately covered with bags for several hours. None of the usual sprays exercises any appreciable degree of control of this disease.

[TO BE CONTINUED.]

Hand-feeding Sheep in Drought Time.

G. R. MOULE, Officer in Charge, Sheep and Wool Branch.

(*Continued from page 306 of May issue.*)

Organising Drought Feeding.

A GOOD deal of organising is necessary to carry out drought feeding successfully. This will include arranging for regular market reports in order that the feed can be bought to the greatest advantage, arranging rail and road transport, and distributing the feed to the sheep so that each animal gets its proportionate share. The mechanics of the former points do not come within the scope of this article, but woolgrowers are reminded that they should always have one month's feed on hand. In addition, the station truck should be kept in good order.

The distribution of the feed is an important consideration. It is not really necessary to feed the sheep every day. Feeding twice a week will suffice, though better results will be obtained by feeding three times a week. This greatly reduces the labour, but the whole of the week's ration should be distributed between the three feeds. However, it is inadvisable to treat ewes heavy in lamb this way.

Feed dumps which are protected from birds should be established close to feeding points and where more than one flock is being fed the feeding days may be alternated, thereby saving manpower.

There is no doubt that trough feeding is the most economical way of distributing the food. Obviously, troughs must be used when feeding meal or cracked grain. Troughs can be made from logs, galvanized iron or bags threaded on wires about 24 inches apart and from 8 to 12 inches from the ground. It is necessary to allow not less than 50 running feet of trough per 100 ewes heavy in lamb or with lambs at foot. One particular advantage of bag troughs is that sheep cannot become cast in them.

Plates 177 and 178 show the types of bag troughs commonly used. The advantage of the type shown in Plate 177 is that it can be filled from an automatic hopper fixed on the front of a truck (Plates 179 and 180. This greatly reduces the labour required in feeding and expedites the work.

Hay might be distributed by breaking up the bales on the ground (Plate 181) or fed from racks made by stretching 3-inch netting on posts set in the ground to form a V angle (Plates 182 and 183).

As success in drought feeding is largely dependent upon buying correctly, the composition of the rations fed to the sheep sometimes varies considerably with fluctuations in market prices. This calls for care in changing from one feed to another and it is advisable to do this gradually, allowing the sheep time to get used to the new food.

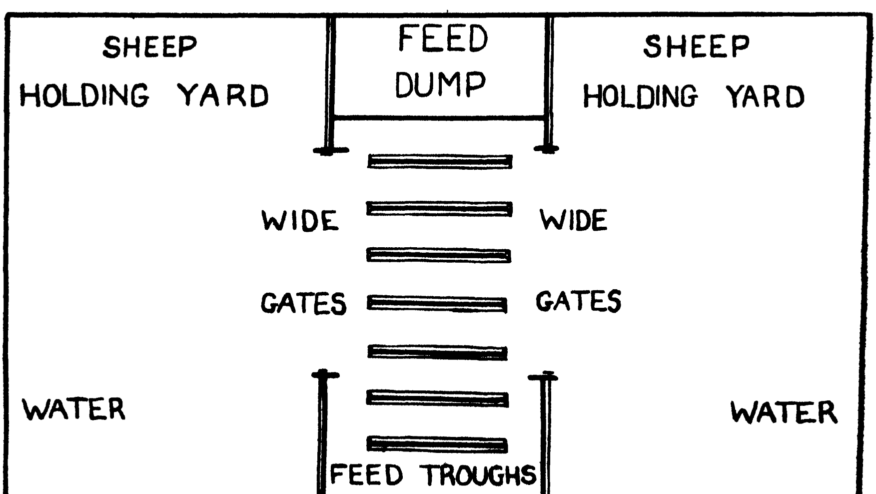
Flock Management in Relation to Drought Feeding.

Sometimes difficulty is experienced in teaching a flock to feed. Should it become necessary to feed, it is advisable to get a few sheep into a small yard and starve them for a day or so, but allow them adequate water. Then offer them some of the food which is to be used; it is often advisable to put a little fairly fresh lucerne or some palatable weeds such as thistles on top of the trough.

When they become accustomed eaters these sheep can be returned to the flock to act as "coaches." It is probable that some sheep will never become "feeders," and those which constantly refuse to eat may as well be turned out into whichever paddock has the best top feed.

In country where worm infestation is likely to occur it is always advisable to drench the sheep, preferably with phenothiazine, at the commencement of feeding.

The object in drought feeding is to maintain the sheep with the maximum economy. Under absolute drought conditions, when it is necessary to hand-feed completely, the sheep do not get enough food when wandering about the paddock to supply the energy requirements for walking. Accordingly, it is preferable to restrict the amount of walking and establish feeding yards near water (Plate 184). The flocks should be drafted according to strength and it is preferable to keep the animals in large shady yards with a set of feeding troughs from which the sheep can be excluded. The accompanying diagram suggests a suitable arrangement.



Alternatively, the troughs can be arranged as a long length as shown in Plate 177. This is necessary when they are filled from an automatic hopper fixed to a truck, as shown in Plates 179, 180, and 186. If an automatic hopper is not used it is preferable to distribute the feed from bags which are about half full. This makes handling easier.

Some idea of the amount of feed which can be saved by yarding the sheep as against allowing them to roam the paddock can be gained from the fact that it would require an additional half ton of maize per 1,000 sheep per week to provide for their walking six miles per day. Feeding near a reasonably salty bore is another way of keeping the sheep handy to the feeding points.

If the sheep are weak when feeding commences it is better to feed heavily for the first two weeks to strengthen the flock quickly. For this purpose maize is outstandingly good and it is better to use it almost irrespective of cost. Any additional expense incurred will be recouped subsequently in decreased losses of sheep. One-and-a-quarter times full feeding plus roughage is a reasonably safe level to suggest for the first two weeks' feeding. That is to say, increase 6 oz. of maize (or its equivalent) to about 8 oz. per head per day, 8 oz. of maize to 10 oz. of maize per head per day, or 12 oz. of maize to 16 oz. of maize or its equivalent per head per day. If there is a wide variation in the strength of the sheep when feeding is commenced it is advisable to draft on a strength basis immediately. If, on the other hand, the whole flock is weak this need not be done when feeding is commenced, but it is advisable to do so at the end of the first or second week of heavy feeding. Consideration can then be given to reducing the ration for the strong sheep but maintaining it for the weaker ones for a little longer.

Special care has to be taken in feeding lambing ewes. The most important principle is to wean early and feed the young sheep. It may be necessary to wean the lambs into yards, but this is preferable to letting them hang on the mothers. Creeps, which must be placed in the shade, may be used for a couple of weeks before weaning to encourage the lambs to eat. Once they are removed from their mothers they should be fed fairly heavily on a weight basis and roughage must be included in their diet. Lucerne, hulled oats and poultry growing mash are all useful for this purpose because of their high protein content. (Growth is essentially a period of protein storage.)

If the ewes are taken in hand prior to lambing and it is desired to save the lambs, it is advisable to feed the ewes a protein-rich meal to stimulate milk supply, but it is still advisable to wean early.

In cases where the sheep are very weak and the lambing poor, some owners prefer to sacrifice the lambs.

Very often the heaviest losses associated with drought feeding occur when the drought breaks. The precautions to take include:—

(i.) Maintaining a reasonable dump of feed close to the sheep so that feeding will not be interrupted through lack of supplies.

(ii.) Continue feeding (and it is preferable to use roughage for this purpose) until there is a reasonable body of feed—don't let the sheep chase a pick. The sheep will have to walk further to feed than their strength will permit.

(iii.) Do not let the flock scatter when it rains. This is not so bad if they are on good hard red country, except that they will probably go off chasing a pick. On black soil heavy losses can occur through bogging. If clouds come up and rain is promising it is advisable to feed the sheep into yards and/or the shed. This will prevent them scattering and the extra feed will probably be quite useful.

ACKNOWLEDGEMENTS.

It is desired to acknowledge the assistance of those woolgrowers who have placed all details pertaining to their experience with drought feeding at my disposal and to record the help given by Dr. M. White, of the Department of Agriculture and Stock.

It is also desired to thank Mr. S. L. Everist and Miss E. Baynes for permission to use unpublished data pertaining to Queensland's climatology.

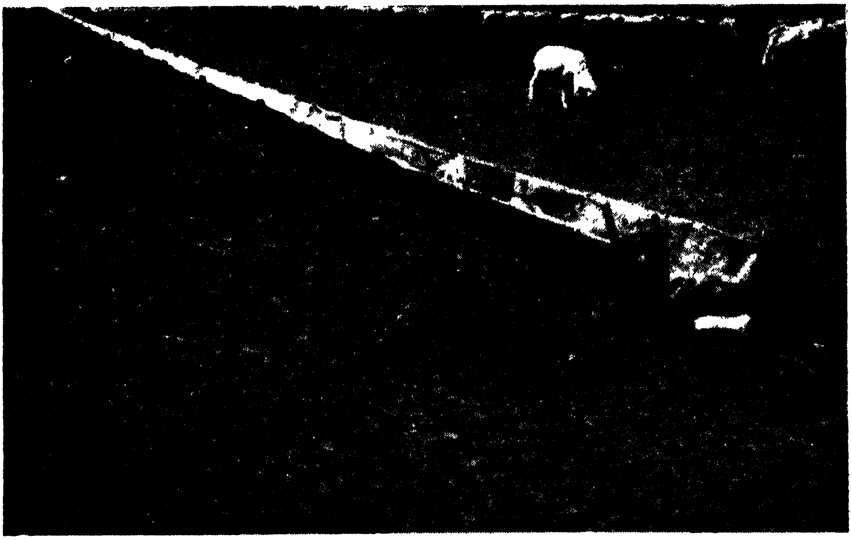


Plate 177.
TROUGH FEEDING.—A length of 700 feet of bag troughing at "Neenah Park," Longreach.

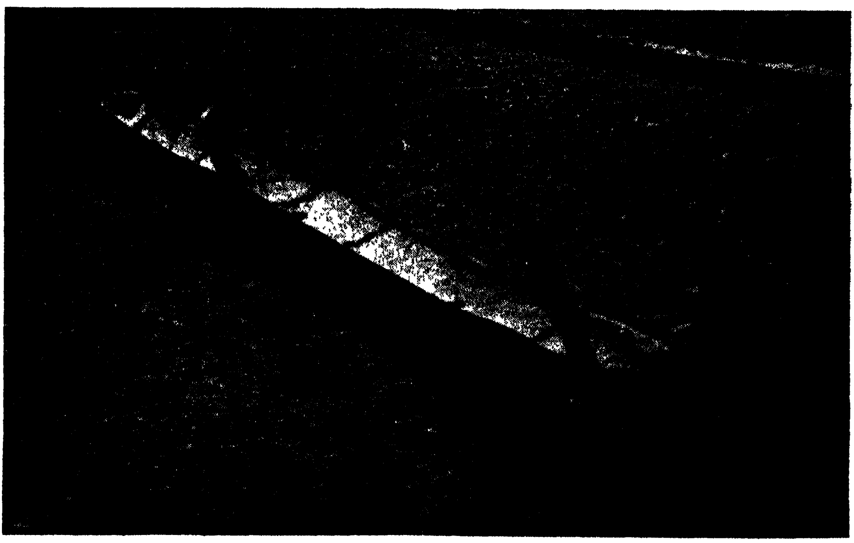


Plate 178.
TROUGH FEEDING.—Short bag troughing used at "Rodney Downs," Ilfracombe.

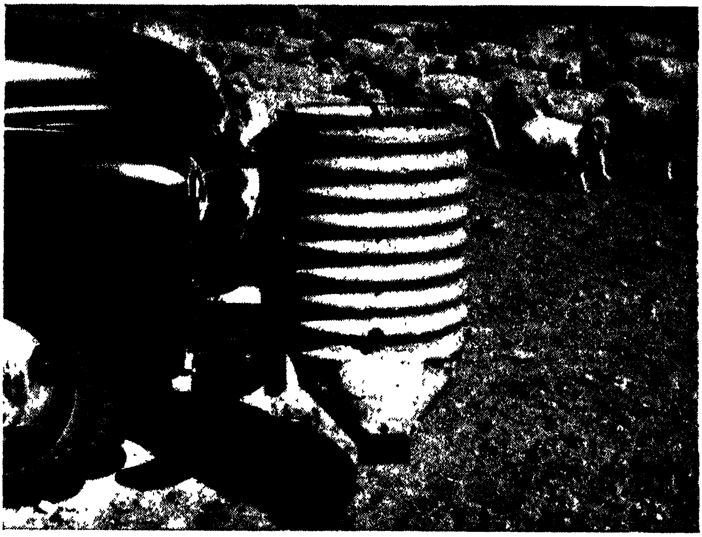


Plate 179.

AUTOMATIC FEEDER MOUNTED ON TRUCK.—Designed and constructed by Mr. Eric Hudson, "Neenah Park," Longreach.

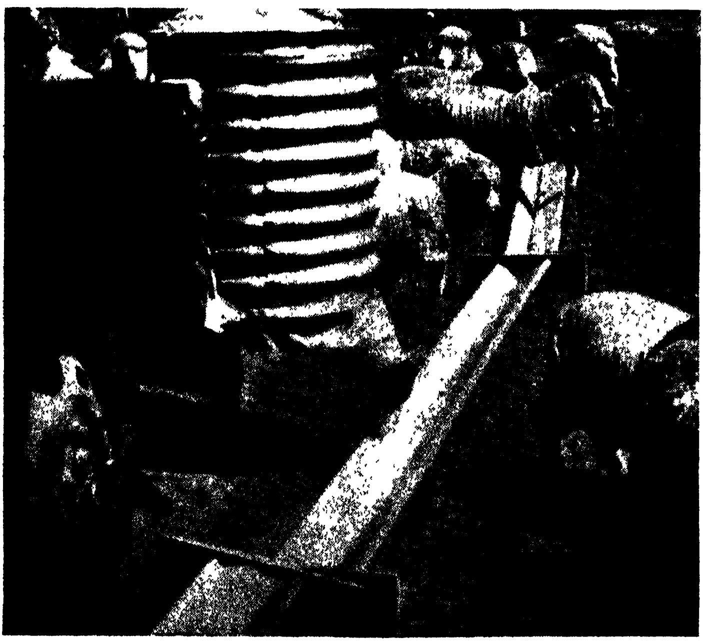


Plate 180.

AUTOMATIC FEEDING.—Another view of the feeder shown in Plate 179.

Plate 181.
SHEEP EATING LUCERNE HAY DISTRIBUTED ON THE GROUND.

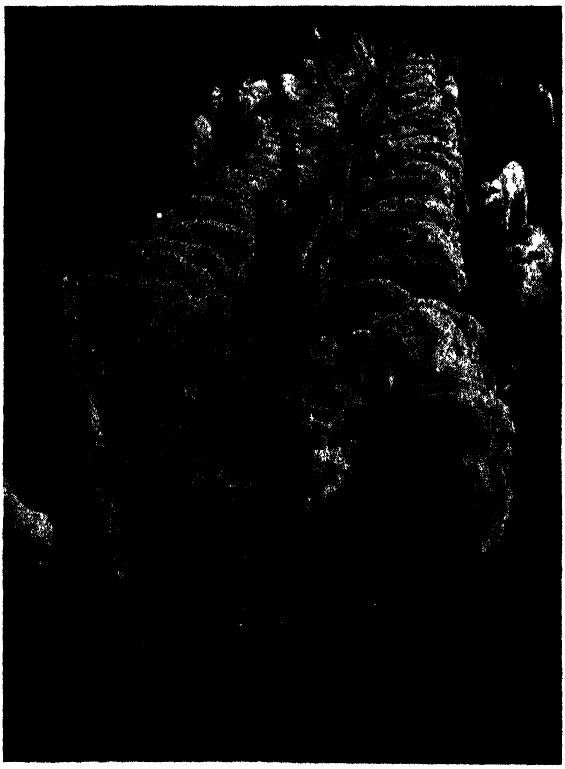


Plate 182.
RACK FEEDING.—Wire netting hay rack designed by Mr. J. Y. Shannon and used at "Rodney Downs," Ilfracombe.

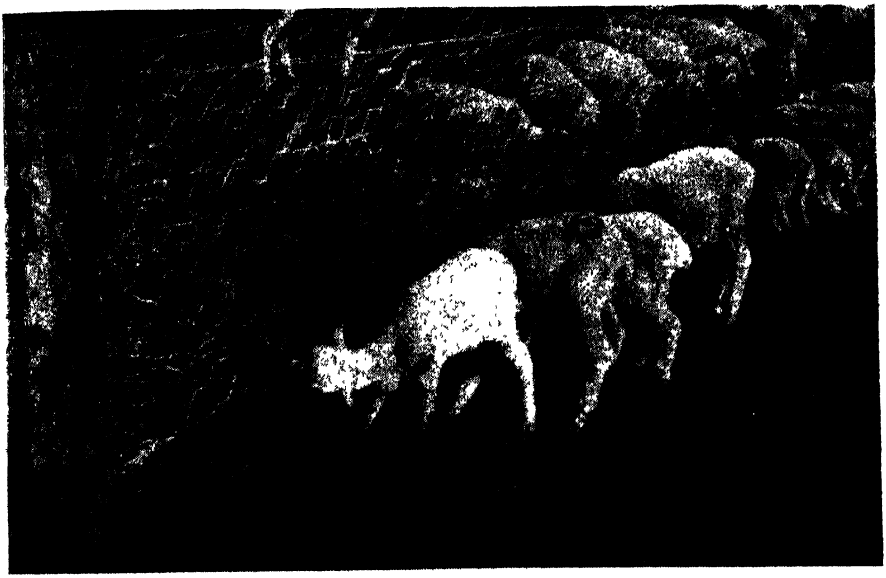


Plate 183.
RACK FEEDING.—Another view of the hay rack shown in Plate 182.

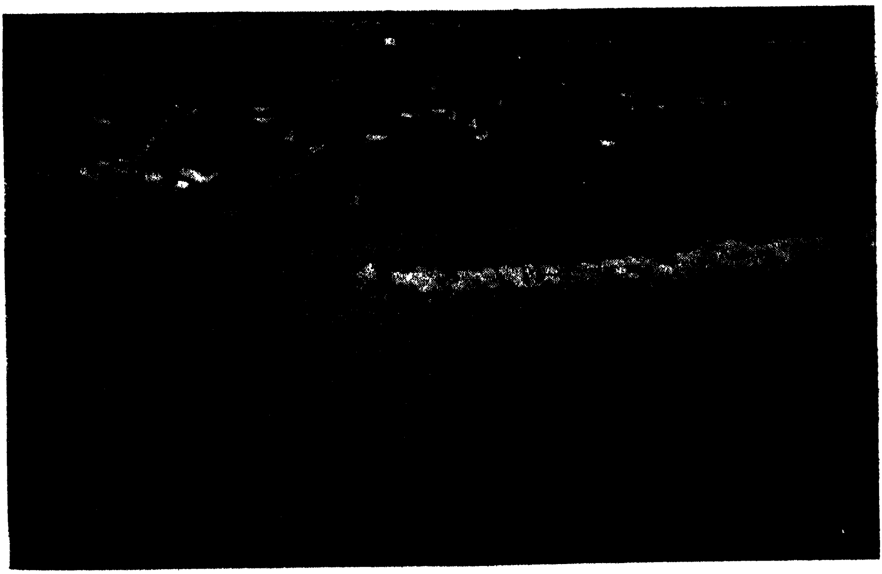


Plate 184.
TROUGH FEEDING SHEEP NEAR WATER.—"Neenah Park," Longreach.

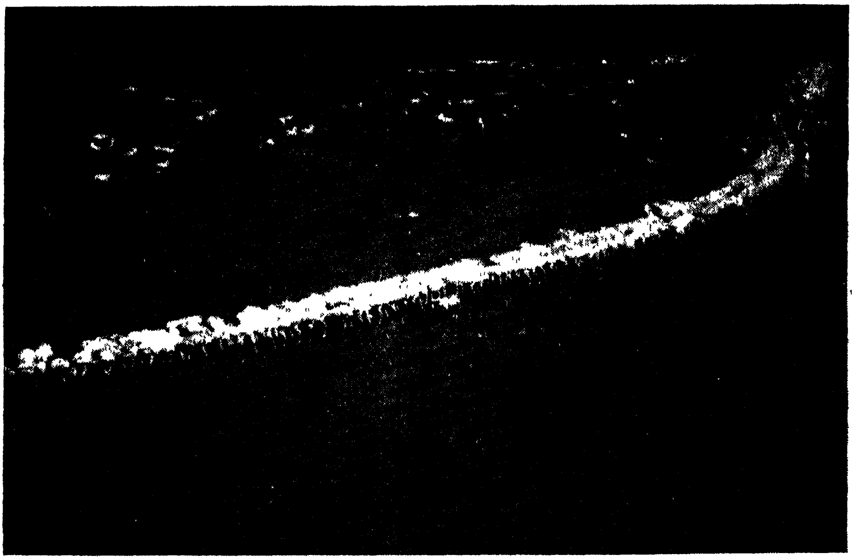


Plate 185.
SHEEP FEEDING FROM LENGTH OF TROUGHING AND HAY BEING DISTRIBUTED FROM TRUCK.—"Neenah Park," Longreach.

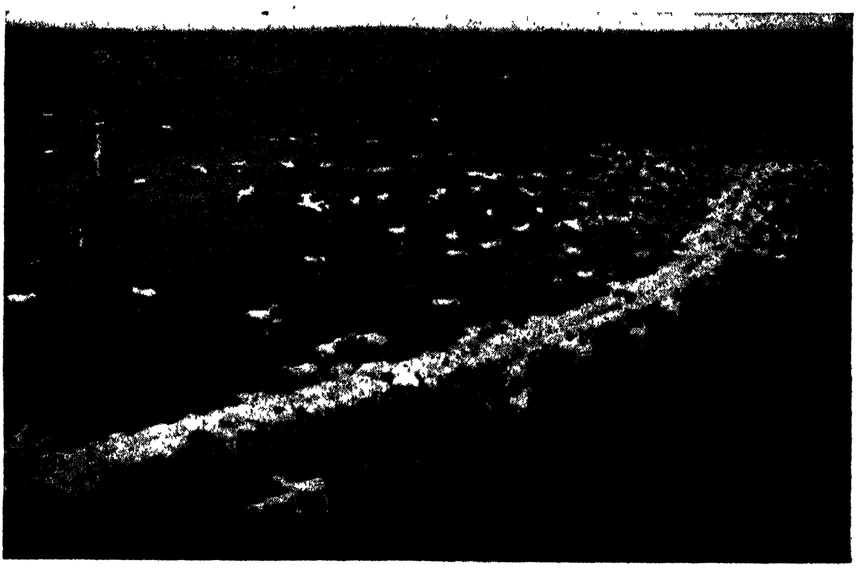
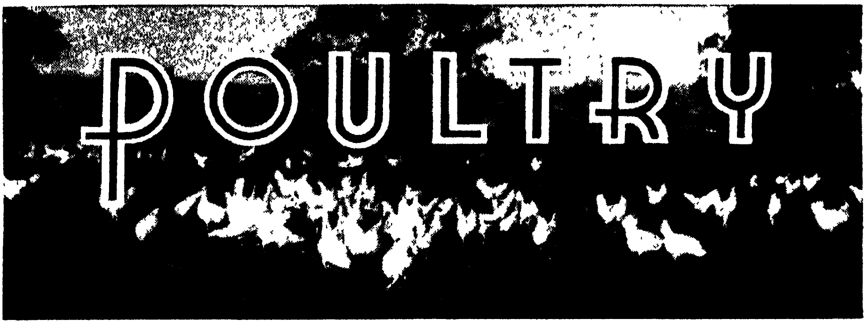


Plate 186.
FILLING THE FEED TROUGHS FROM THE AUTOMATIC FEEDER MOUNTED ON A TRUCK.—"Neenah Park," Longreach.



Poultry Nutrition: Principles and Practices.

P. RUMBALL, Officer in Charge, Poultry Branch, and
F. N. J. MILNE, Assistant Husbandry Officer (Poultry).

MORE and more attention is being focused today on the question of feeding poultry. Added to the vagaries of supplies are high feeding costs, which necessitate the farmer making the most economical use of the materials at his disposal. This is only possible by ensuring that foodstuffs are not inadvertently squandered by underfeeding, by waste which is associated with the use of poor classes of feeding receptacles, by not using dietary supplements when they are necessary, and by the use of these expensive supplements when such are not needed.

It must be remembered that there have been and will be shortages of some of the ingredients in common use in poultry rations. This is due to the fact that some ingredients are the by-products of foodstuffs processed for human consumption. Over the past 20 years the human population of this State has hardly doubled itself. The poultry flocks, however, have increased at least tenfold, with the result that the by-products of processed human foods—that is, meatmeals, bran and pollard—have not increased in the proportion necessary to meet the requirements of this greatly expanded industry.

However, an intelligent study of the principles of poultry feeding and the application of these in the preparation of rations will ensure that poultry farmers obtain the utmost benefit from the foodstuffs available.

THE PURPOSE OF A POULTRY RATION.

The fowl can be regarded as a machine which converts the food consumed into eggs and flesh. How efficiently this is done depends on the inherited tendency for high production, on the type and quantity of food supplied to the bird, and on the general health and environment of the flock.

The purpose of a ration is twofold—firstly, the food furnishes heat, energy, and all the materials necessary for the upkeep of the body; and, secondly, it furnishes the materials for growth and production. From 75 to 80 per cent. of the feed consumed by a healthy bird on a full ration is normally used for the purpose of body maintenance.

The fowl differs from other farm animals in many ways, but particularly in the use of food. The hen has a higher body temperature (107 deg. F.) and exhibits greater activity than any other farm animal. As a result, the processes of digestion have of necessity to be speeded up. Hence, we find various adaptations to meet this need. Firstly, the hen's alimentary tract is short and not very complicated, and is best adapted for the proper use of more concentrated foods. Fowls have neither the capacity nor the structure to digest bulky feeds, such as is possible for a cow. Secondly, a hen eats in proportion to her weight more than twice as much dry matter in a given time as a cow, and uses food more efficiently than any other farm animal.

THE COMPOSITION OF A POULTRY RATION.

The ingredients of a normal poultry ration contain six basic compounds or nutrients—proteins (body-builders), carbohydrates and fats (energy-suppliers), minerals (skeleton, egg-shell), vitamins (utilisation of other nutrients), and water.

A good ration will contain all of these nutrients in such form and variety that proteins of the right type, minerals in proper proportion and in readily available form, and vitamins to bring about the proper assimilation of these elements are provided. Each of these will be considered in detail.

Proteins.

Proteins, along with carbohydrates and fats, are the important constituents of the protoplasm of the living cells and as such form important components of bones, ligaments, soft tissues, muscles, feathers, nails, beaks and skin. They form the nitrogenous part of the food and are mainly used for growth, repair of waste tissue, and production.

Just as a brick is made up of a number of different constituents, so is protein composed of a number of smaller units—all chemically linked together—known as amino-acids. These amino-acids in turn are composed of atoms of carbon, hydrogen, oxygen, nitrogen and sometimes sulphur, phosphorus and iron. Sulphur-containing amino-acids are found in hard external features of the fowl—feathers, nails, scales and beaks.

Twenty-five amino-acids have so far been identified. Most animals are capable of synthesising (manufacturing) some of the amino-acids. Those which cannot be synthesised must be supplied in the diet. These amino-acids are known as the "essential amino-acids." Some of these amino-acids are synthesised by the animal, but are not manufactured quickly enough or in sufficient quantity to satisfy the requirements of the animal: for example, glycine, although synthesised by the fowl, cannot be synthesised rapidly enough to promote growth; it is obvious that glycine must be supplied in the diet. Of the 25 amino-acids so far identified, 11 are absolutely essential to poultry.

On digestion, the proteins are split into smaller and smaller fragments by the action of protein-splitting enzymes. This process is continued until the amino-acid stage is reached. These amino-acids are absorbed through the gut wall and transported to the liver, which is also capable of amino-acid synthesis.

From the liver the amino-acids are carried in the blood stream to all parts of the body where the specific proteins required for growth and repair of tissues are manufactured.

Amino-acids thus derived from these two sources—that is, from the diet and from the liver—are recombined to form the specific body proteins. This is only possible if all of the amino-acids are present. The absence of even one amino-acid group will be reflected in retarded growth and production.

While a diet deficient in protein is deleterious, feeding in excess of body and egg-producing requirements is wasteful and can be harmful. Excess amino-acids are dealt with by the liver in the following ways:—(1) By conversion of amino-acids into carbohydrates or "blood" sugar, which can be utilised for energy production; (2) by conversion into fat, which is stored and used for energy production as the occasion demands; and (3) by the conversion of the nitrogenous portion of the amino-acid into excretory products—urates.

The feeding of excess protein therefore leads to a greater production of urates, which may be deposited in the kidney or liver, thus impairing normal protein digestion, assimilation and excretion.

Most of the essential amino-acids are found in animal tissues and at a sufficiently high level to supplement the vegetable protein—hence the importance of feeds of animal origin. It has been recommended by at least one authority that 20 per cent. of the protein content of a ration should be of animal origin.

Cereals, particularly maize, are low in some of the essential amino-acids, but what is lacking in one cereal may be made up by the use of another containing those amino-acids. Therefore an intelligent combination of grains with the use of animal protein will ensure that no amino-acid deficiencies exist.

Protein Levels.

Growing birds require large quantities of protein. Laying hens, although their requirements for growth are less, must have sufficient to meet the heavy demands of egg-production. In the case of young laying pullets, provision must also be made for an adequate supply of protein, as active growth is still in progress.

Research into the feeding of different levels of protein in poultry rations at different stages to attain optimum growth was conducted by the Queensland Department of Agriculture and Stock from 1931 to 1935.

The graph in Plate 187 shows the growth rates of two groups of White Leghorn chickens on high- and low-protein diets, the protein levels being 17.15 per cent. and 15.01 per cent. respectively. The best results were obtained when the higher protein diet was fed during the first six to eight weeks.

For young growing chickens a further series of experiments showed that the optimum percentage of protein in the ration lies above 18, and protein levels from 18 to 20 per cent. during the first six to eight weeks give a greater gain in weight.

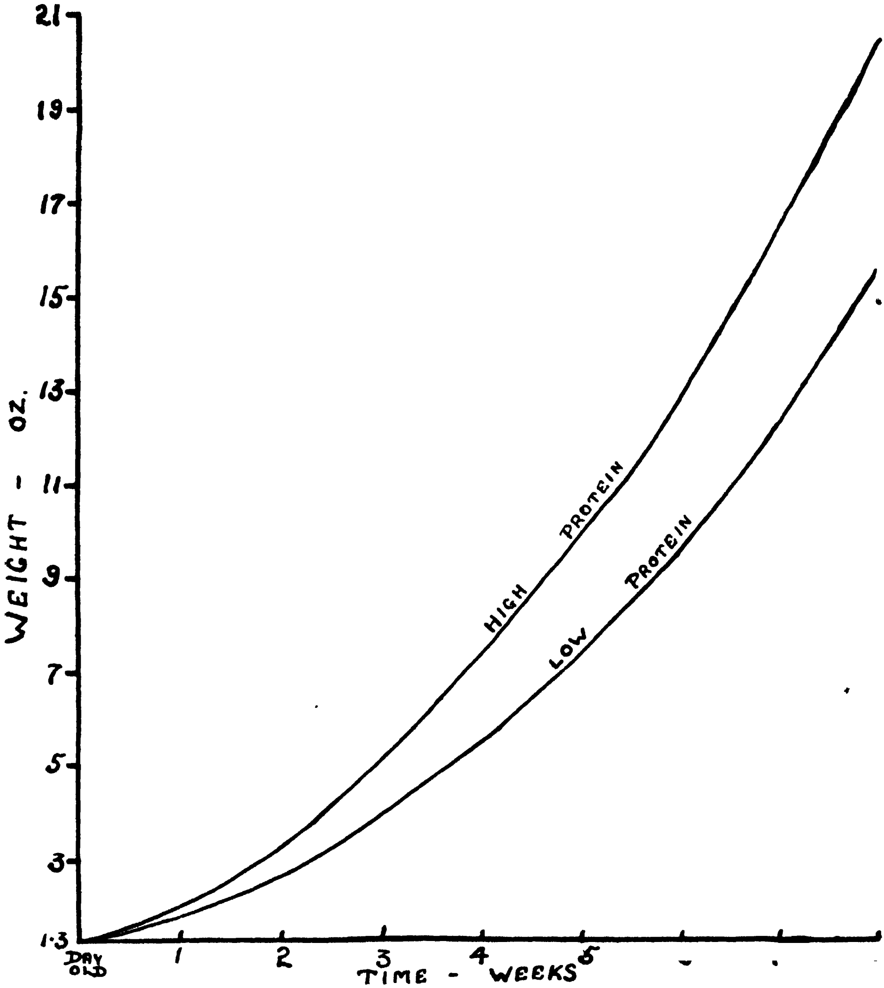


Plate 187.

As the birds near maturity this high level can be lowered—a gradual reduction by feeding increased quantities of grain—to between 15 and 16 per cent. The protein requirement of a chicken does not alter as sharply as this, but these periods and protein content are suggested as meeting the practical requirements of the poultry raiser.

Insufficient Protein.

Growth is retarded, sexual activity may be delayed and eventual egg production affected if insufficient protein is fed. Some workers have also observed cannibalism and feather picking amongst growing stock on a protein-deficient ration.

Excess Protein.

A protein level of 30 per cent., in addition to being wasteful, has been found to be toxic to growing stock. This toxicity is due, no doubt, to the overloading of the excretory organs by the accumulation of urates.

Carbohydrates.

Carbon, hydrogen and oxygen are the elements which, in chemical combination, form the carbohydrates. There are two classes of carbohydrates—the sugars, which include the more complex forms such as starch, and cellulose or fibre.

During the process of digestion, particularly in the higher animals, the starches and sugars are broken down and converted into simple sugars, which are absorbed through the gut wall into the blood stream and conveyed to the liver and muscles.

Their function is to provide energy for (*a*) movement, (*b*) maintaining the correct body temperature, (*c*) supplying the vital body processes such as the beating of the heart, and (*d*) the functioning of the organs of respiration and the alimentary canal.

Only after these requirements have been met can the excess carbohydrates be utilised for egg-production. Any excess beyond this in the laying bird would be converted into fat and stored in the body. Some of the surplus may also be converted into glycogen or animal starch and stored in the liver and muscles. This can be reconverted into glucose when the level of blood sugar falls below a certain limit.

Fibre or cellulose is derived from the plant cell walls. It cannot be fully utilised by the fowl, for research has shown that no cellulose-splitting enzyme exists in the fowl's digestive juices. There is little time available for digestion; hence little or no conversion to the simpler carbohydrates is possible.

Carbohydrate Levels.

A shortage of carbohydrate is never likely to occur in poultry rations, because of the high percentage of grains fed either whole or as meal.

Fibre Levels.

While fibre contributes little or nothing to the digestible nutrient part of a ration, it plays an important part in the efficiency of digestion. A ration containing less than 5 per cent. of fibre becomes compacted, with the result that the digestive juices do not mix intimately with the food.

A very fibrous ration (above 9 per cent.) not only reduces the amount of food eaten owing to its bulk, but also irritates the intestines and impairs digestion, and thus production. The most desirable fibre level is approximately 7 per cent.

Fats.

Carbon, hydrogen and oxygen, as in carbohydrates, form the essential elements of fats. They are also energy-suppliers and, weight for weight, when utilised within the body, liberate 2¼ times as much energy as carbohydrates. Body fat is derived from the diet directly from the fat present and indirectly from the conversion of excess carbohydrates and protein above the body and egg-producing requirements. The conversion of protein is a one-way process. Thus, a ration deficient in protein, no matter how rich in fats and carbohydrates, cannot give adequate growth.

The presence of a moderate amount of fat in the diet probably has a beneficial influence on the absorption of calcium and phosphorus, since the fatty acids maintain a favourable acidity in the intestinal contents. This state of acidity helps to keep these minerals in solution.

There is a certain optimum level, for dietary research has shown that a diet containing a high percentage of free fatty acids—for example, rancid meatmeal—exerts an adverse effect on growth and feed consumption of chicks. In any case, in the present state of our knowledge, a fat content higher than 5 per cent. cannot be recommended.

Minerals.

Minerals are often referred to collectively as ash, which is that portion of a plant or animal which is left after burning. Minerals enter into practically all functions of the body, and in particular into the formation of bone and egg-shell.

Of major importance as far as quantity required and direct influence are calcium and phosphorus. In addition, certain other minerals, though occurring only in minute amounts, are directly responsible for the normal well-being of the fowl. These are known as "trace elements" and will be dealt with later.

Calcium and Phosphorus.

The formation of the bony skeleton and egg-shells is dependent upon the availability of sufficient quantities of calcium and phosphorus in the ration. The laying hen is entirely dependent upon dietary calcium and phosphorus, for, if the supply were stopped, there would be only enough calcium and phosphorus available from the skeleton to provide about three or four eggs. Grains and their by-products, which form the bulk of poultry rations, are deficient in both of these minerals. In addition, most of the phosphorus present in grains is combined with another organic substance as phytin and in this form cannot be assimilated by the fowl.

It is therefore essential that both of these elements be supplied in the ration. Animal by-products—meat and bone meals—supply phosphorus and some calcium, while calcium is derived also from limestone or shell grit supplied either separately or incorporated, in powdered form, in the mash.

The ratio between the amounts of calcium and phosphorus in a ration is a very important factor, since an excess of one may result in a depletion of the other—for example, an excess of calcium may cause some of the calcium to combine with the phosphorus in the gut to form an insoluble compound, calcium triphosphate. The excess of calcium may also hinder the absorption of manganese.

Much research has been carried out to determine the proper balance for calcium and phosphorus in the diet. It has been found to closely approximate the ratio in which these two minerals occur in the bony skeleton, namely 2:1.

Starting and growing rations should contain at least 1 per cent. calcium and 0.6 per cent. phosphorus. Layers and breeders require at least .75 per cent. phosphorus, with the calcium level at two to three times this value.

However, even if a perfect calcium/phosphorus balance is struck, there will be poor utilisation unless vitamin D is present. This inter-relationship will be discussed when dealing with vitamins.

Trace Elements.

In addition to calcium and phosphorus, which are supplied in relatively large quantities, minute amounts of certain minerals are needed for the general well-being of the bird.

Manganese.—There is ample and increasing evidence of the great practical importance of manganese in poultry nutrition. It was first shown that manganese had a direct bearing on the incidence of perosis or "slipped tendon" in poultry. Today we know that it also plays a major part in successful bone formation, egg-shell structure and hatchability. Poultry farmers must be ready to guard against a deficiency of this mineral because bran and pollard, both naturally rich sources of manganese, are very often in short supply. In addition, the manganese content of whole grains varies considerably, not only between different types of grains but within the same kind. Wheat averages about 39 parts per million as against 5 parts per million found in maize. Research workers in Western Australia carried out manganese estimations on 208 samples of wheat. The range varied from 19 to 84 p.p.m. with a mean value of 37 p.p.m.

From the foregoing it can be seen that more and more attention must be paid to meeting the manganese requirements of poultry. The nutritional requirements for light breeds is set down as 40 p.p.m., and for heavy breeds as 50 p.p.m.

It is suggested that to guard against any possible deficiency (900 p.p.m. of manganese have been fed before toxicity results) 4 oz. of manganese sulphate be added to every ton of mash. This can be incorporated by first mixing it intimately with the salt.

Iron and Copper.—Iron is required for the formation of haemoglobin, the oxygen-carrying compound of the red blood cells. This formation cannot take place unless traces of copper are present. Thus a diet deficient in either of these minerals gives a poor development of blood cells, with resultant nutritional anaemia.

In the laying hen, the demand for iron and copper for egg formation is increased, since the average egg yolk contains 0.0143 per cent. iron and .00076 per cent. copper; hence the ration must contain an adequate amount. In some cases where plenty of green feed is not available iron supplements may be necessary.

Generally speaking, dietary needs, especially in young chickens, are covered adequately by feeding iron-rich young greenstuffs (lucerne meal and cereals) and iron-rich animal proteins in animal by-products.

One danger which has to be faced when supplementing a ration with iron-containing compounds is that too great an excess of iron will interfere with the absorption of phosphorus. Rickets have been produced experimentally by feeding high levels of iron supplements.

Sodium Chloride (Salt).—Common salt plays a vital function in the physiology of the fowl. It forms a considerable part of the straw-coloured fluid or plasma of whole blood. Salt is also required for the manufacture by the fowl of hydrochloric acid, which is secreted in the

stomach. Inclusion of salt up to 1 per cent. of the mash is recommended. An excess may cause salt poisoning, as salt in too great a quantity is extremely toxic to fowls.

Vitamins.

Vitamins are complicated chemical substances essential in minute quantities for normal life. A ration otherwise perfect but lacking certain of these vitamins will lead to disastrous results. Of the vitamins playing an important role in poultry nutrition, vitamin A is probably of the greatest importance. The vitamins are classified broadly into two groups—the fat-soluble (A, D, E and K) and the water-soluble (B complex).

Vitamin A.

Vitamin A is the most important vitamin in poultry nutrition and its deficiency one of the most common diseases in this State. It is of paramount importance because it enters into every phase of the bird's life and the functioning of its life processes. In breeding stock it is necessary for good production, fertility and hatchability. In chickens and growing stock it promotes growth and health, appetite and digestion, and increases resistance to many infectious diseases, particularly those of a respiratory nature. Recently it has been shown that mortality due to coccidiosis is far greater amongst chickens on a vitamin A deficient diet than in those on an adequate ration.

In severe cases, lack of this vitamin leads to the drying-up and hardening of the membranes covering the eye and the trachea, giving the typical "eye roup" condition of poultry and pustules in the pharynx.

The kidneys may also be affected. They may be enlarged and whitish in appearance, due to accumulation of urates.

There is lowered resistance to parasites, particularly to round worms harbouring in the alimentary canal. Many a post-mortem has revealed a vitamin A deficiency complicated by the presence of a heavy infestation of round worms.

All green plants, particularly fresh green lucerne, and lucerne leaf meal are rich in vitamin A. Vitamin A is present in the form of carotene, which is converted into vitamin A in the body. It is often called provitamin A. Fresh green lucerne hay has about five times as much vitamin A as yellow maize, another good source.

Lucerne, as hay, chaff or meal, loses a lot of its vitamin A content on being stored. Bran and whole wheat contain very small amounts. Fish oils are an excellent source of vitamin A, but they should be valued on their vitamin content, which is variable. The amount of green colouring in freshly cured fodder crops is an indication of their vitamin A content.

Fresh green feed is by far the most economical source of vitamin A. Failing that, a ration containing at least 30 per cent. of yellow maize and 5 per cent. of choice fine-cut lucerne chaff or lucerne meal should meet the needs of layers. If no yellow maize is available, then up to 10 per cent. of lucerne should be fed. Cod-liver oil or other approved fish oil is at times unprocurable, but when available 1 per cent. of a good

grade containing 1,000 I.U. per gram may be added to the ration to supply vitamin A. More concentrated forms of fish oil with a higher vitamin A potency are also available. In this case smaller amounts will be required. Fish oil, however, is generally costly compared with fresh green feed or lucerne chaff. Further, the lucerne or green feed provides other valuable food factors. A regular supply of 5-6 lb. of green feed per 100 hens per day is recommended.

Vitamin A is a very unstable substance. It is destroyed by excessive heating and exposure to air, due to oxidation. For this reason it is unwise to store mashes to which fish oils have been added for any length of time, as the vitamin A content decreases rapidly. It has also been found that charcoal in the mash can have a deleterious effect on vitamin A.

Vitamin D.

Vitamin D aids the assimilation and utilisation of calcium and phosphorus. Lack of this vitamin, even though the dietary levels of calcium and phosphorus are adequate, will result in poor bone formation and death in growing stock (that is, rickets) and the production of thin and soft-shelled eggs in layers. Hatchability as a result would also be seriously affected.

Two sources of vitamin D are available. For birds housed intensively it is essential to add a fish oil containing vitamin D to the ration. If fowls have sufficient exposure to sunlight, there is little likelihood of a vitamin D deficiency, since the ultraviolet rays of sunlight convert substances in the skin and feathers of the fowl into vitamin D and adequately supply the bird's requirements.

The term vitamin D actually embraces several related compounds. Two of these are of interest in poultry nutrition—namely, vitamin D_2 and vitamin D_3. The first form of vitamin D, known as calciferol, can be utilised by the rat but not by the fowl. Vitamin D_3, the naturally occurring form of vitamin D, is fully utilised by the chick.

This vitamin is much more stable than Vitamin A, being very resistant to heat, oxidation, and storage.

Vitamin E.

Vitamin E, though not necessary for egg production in laying hens, is necessary for embryonic development. One of the most striking symptoms of vitamin E deficiency in growing stock is "crazy chick" disease, which may or may not have a sudden onset.

The vitamin is found in large quantities in wheat germ and meal, and to a lesser degree in pollard, fresh green feed, good quality lucerne meal or chaff, and whole grains.

As yet probable quantitative requirements for poultry have not been determined, but most good rations appear to be adequate in vitamin E.

It is relatively stable to heat but is rapidly destroyed in the presence of fats which go rancid. This may occur when poor quality meatmeal or poor quality fish oil is incorporated in a mash.

Vitamin K.

Vitamin K, known as the anti-haemorrhagic vitamin, is of importance in the clotting of blood. Lack of this vitamin increases the time taken for blood to coagulate and therefore increases the probability of mortality through injury.

Lucerne meal, green feed, liver meal, and meatmeal are the chief sources. Good quality lucerne fed at a 2 per cent. level will satisfy the vitamin K requirements of poultry.

Vitamin B_1 (Thiamin or Aneurin).

This vitamin is essential to the fowl for the promotion of appetite, digestion and growth, aid in resistance to parasites, and maintenance of normal excretion. It is present in so many ingredients of ordinary poultry rations, including grains and their by-products and fresh and dried green feeds, that a deficiency of the vitamin is very unlikely to occur.

Vitamin B_2 (Riboflavin).

Riboflavin is essential for growth, health, and body maintenance. Its deficiency causes "curled-toe paralysis," usually at about 3 to 4 weeks of age. In adult hens a deficiency of the vitamin causes a drop in egg production and a marked reduction in hatchability. Many embryoes develop to an advanced age but die in the shell.

The vitamin is present in dried yeast, dried whey, skimmed milk, buttermilk powder, lucerne hay and meal, soybean meal, pollard, bran, maize, cottonseed meal, and animal protein.

Dried yeast and liver meals have the highest riboflavin content, but if these are unavailable milk powders (dried buttermilk or dried whey) constitute the best supplements with which to fortify any ration. The synthetic product can now be obtained and is equally effective for all purposes.

Niacin.

Niacin, the pellagra-preventive factor, is necessary for normal growth, egg-production, and the prevention of inflammation in the mouth and crop. Excellent sources of niacin are liver meals, brewer's yeast, wheat bran, and lucerne leaf meal. Maize, oats, peanut and soybean meal are poor sources.

Pantothenic Acid.

Pantothenic acid must be present in the diet of chickens to ensure normal growth, development, feathering, and the prevention of skin disorders (dermatosis). Chicks with dermatosis have scabbing in the corner of the mouth, and their eyelids become thickened and may stick together. Cracks may appear in the feet. These symptoms usually occur at approximately 3 to 4 weeks of age.

Milk by-products, yeast, liver meal, molasses, lucerne meal, and wheat by-products are good sources of this vitamin.

Pyridoxin (Vitamin B_6).

Pyridoxin is necessary for growth and maintenance of appetite and the prevention of a certain type of convulsions. Chicks fed a pyridoxin-deficient diet show a small initial gain, then cease to grow or grow very slowly. Some chicks show abnormal excitability, spasmodic convulsions and sometimes twisted and retracted necks.

Pyridoxin deficiency in mature birds is characterised by loss of appetite, followed by rapid loss of weight and death. Egg production and hatchability are reduced markedly.

Pyridoxin is found in cereal grains, bran, pollard, liver meal, yeast, fresh green feed, and lucerne meal.

Biotin.

Biotin is necessary for growth and hatchability. It is also involved together with manganese and choline in the prevention of "slipped tendon" or perosis.

In biotin deficiency in chicks skin disorders first appear at about 3 weeks of age. These lesions are very similar to those occurring in pantothenic acid deficiency.

The chief sources of biotin in the ration are grains, liver, molasses, lucerne meal, and fresh green feed.

Choline.

Choline is necessary for growth, bone development and egg production. A lack of choline in the diet of young chickens and turkeys results in retarded growth and perosis. It has also been noted that in the relative absence of choline there has been marked fatty infiltration of the liver.

Good sources of choline are grains, wheat by-products, meat and liver meals, milk products, and peanut meal.

Folic Acid.

Growing chicks must have a little-known and only recently discovered vitamin called folic acid for normal growth, feathering and blood-building. Latest information on the sources of this vitamin indicates that the leafy parts of plants, liver meal, and yeast are good sources, while cereal grains and by-products, linseed meal, and meat-meal also contain the vitamin in appreciable amounts.

It is indeed significant to know that the vitamins discussed are also essential in human nutrition and are found to a greater or lesser concentration in poultry products, both eggs and flesh.

Thus if these factors are present in the feed, it is obvious that not only are poultry supplied with their essential vitamins but that the resulting product will also be of greater nutritive value.

[TO BE CONTINUED.]

MARKETING

The Development of the Wheat-growing Industry in Queensland.

C. H. DEFRIES, Assistant Director of Marketing.

APART from its dominant position in certain summer grains, such as maize, sorghum, millets, &c., Queensland has never been regarded as a grain-producing State, and the rapid progress now being made by the wheat industry, together with such enterprises as the Queensland-British Food Corporation's sorghum-growing project in Central Queensland, is therefore of particular significance in the assessment of the future of agricultural production in Queensland.

Queensland has always been essentially a pastoral State and no extensive grain industries developed as they did in other parts of Australia subsequent to the gold rush in the middle of last century, to be followed later by advances in the technique of harvesting, transport and marketing that made Australia a major wheat-exporting country.

Natural conditions in Queensland are such that the pastoral industry will continue to maintain its status and importance in the rural economy, but recent developments give rise to the hope that there will be in the future a closer association between the grain, pastoral and other industries.

The expansion of the wheat industry in Queensland, together with the enactment late in 1948 of legislation by the Governments of the Commonwealth and States to give effect to an Australia-wide scheme of wheat industry stabilisation and marketing, provides an opportune time to outline the salient features of the development of the industry in the States that will, it is hoped, afford a background against which to examine the problems with which it is confronted.

Peculiarities of the Queensland Wheat Industry.

A review of this nature is particularly desirable at this period of expansion because the wheat industry in Queensland has certain peculiarities which distinguish it from the industry in other States. These may be briefly summarised as follows:—

(*a*) In the past, the crop in Queensland was confined, to an important degree, to the status of a relatively minor component of mixed farming in which dairying and, to a lesser extent, sheep raising, were the major activities. However, there has been a marked shift of emphasis from the valleys of the south-eastern Downs to the more extensive areas of the north-western and western Downs which have become available since the destruction of prickly-pear by Cactoblastis. This may be contrasted with the position in other States, where the area tends to contract with the elimination of the marginal country.

(*b*) Wheat growing in Queensland is subject to greater hazard than obtains in the main wheat areas of the southern States since the rainfall is predominantly summer in its incidence. However, widespread mechanisation and the development of suitable varieties have been influential in overcoming many of the risks involved.

(*c*) Queensland wheats have been found to possess superior qualities for flour milling, and thus are in a position to command a premium market as compared with f.a.q. wheat.

(*d*) The industry has gained material advantages by reason of the operations of the Queensland State Wheat Board, which was set up by *The Wheat Pool Act* on 2nd December, 1920, and which was the forerunner of the many commodity marketing boards established for other industries under State marketing legislation.

These matters are dealt with in greater detail in the notes below.

Growth of the Industry.

The past two seasons have resulted in record wheat crops of 10½ and 14 million bushels respectively, but it is as well to note that this rapid change from a position where the State did not produce sufficient wheat for local consumption needs to one where a substantial surplus becomes available for export is essentially a resumption of a pre-war trend influenced primarily by the availability of new varieties, mechanisation, and the new lands opened up by the destruction of prickly pear.

However, until the years immediately prior to the second world war the industry was essentially made up of small-scale enterprises associated mainly with the dairying and, to a lesser extent, the sheep industries.

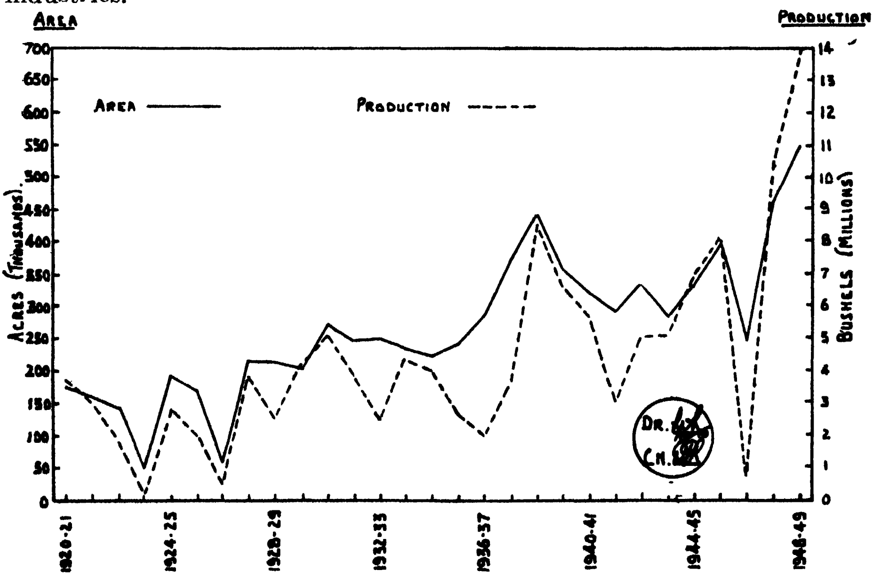


Plate 188.

WHEAT IN QUEENSLAND.—Graph showing area planted to wheat for grain and grain production, 1920-21 to 1948-49.

Plate 188 shows the trend of plantings and production since 1920-21. Of particular interest is the steady expansion of acreage just prior to the war, the decline during the war years, and the recovery that is now taking place. The fall in acreage in the 1946-47 season was due to severe drought conditions, which prevented planting in many areas.

Briefly to review the growth of the industry, statistical records show that in the 1860-61 season Queensland grew 196 acres and produced 3,140 bushels of wheat. Just prior to the 1914-18 war the industry had developed to the extent of producing $1\frac{3}{4}$ million bushels from 130,000 acres, or $1\frac{3}{4}$ per cent. of Australian production. Although production increased up to the 1916-17 season as a result of the "Grow More Wheat" campaign during the first world war, fluctuating prices in the later years of the war and scarcity of labour reduced profits from wheat growing, and there was a very sharp decline in production up to 1918-19, when only 22,000 acres were planted.

At this period the industry was concentrated on the southern and central Darling Downs; the crop was grown to a significant extent for grazing or hay, and only in favourable seasons was it harvested for grain. This, of course, still applies to a large extent to these particular areas, but they are not now so representative of the wheat districts as a whole. Moreover, variations in the differential between the profits from wheat growing and profits from dairying had a marked influence on the production of wheat for grain on individual farms.

The fluctuations of the early post-war years clearly show the effects of these variations. They continued during the depression years of the early 1930's, when the drastic fall in the price of wheat influenced many farmers to engage more exclusively in stock-raising activities, particularly dairying, than in growing crops for grain. In 1932-33, for instance, of 1,927 farms growing wheat in Queensland, only 500 were growing over 100 acres of wheat. However, it is of interest to note that following an increase to 272,000 acres in the 1930-31 season, due in fact to another "Grow More Wheat" campaign, the acreage fell back only to 250,000 acres in the following year despite the price collapse, and remained fairly constant until the 1937-38 season, when the major expansion commenced. Apparently some farmers compensated for the fall in prices by increasing the area planted in order to maintain turnover in an effort to meet fixed commitments. This served to offset the reduced areas of those who turned to dairying.

By 1935 land that had been reclaimed from prickly pear was becoming available, and increased acreages resulted. This continued until the 1938-39 season, when 450,000 acres were harvested for grain. This expansion was interrupted by the war and recovery was very slow until the 1947-48 season, when the area harvested totalled 469,462 acres. A further increase to 550,000 acres for the 1948-49 season indicated that the strong upward trend had been resumed.

During the war many factors limited the trend toward expansion. The stabilisation plan initiated early in the war years limited acreage to a pre-war basis, and although this restriction was later relaxed as far as Queensland was concerned the imposition of the quota plan, which provided for a guaranteed price restricted to the first 3,000 bushels produced on a farm, had the effect of diverting some farm resources to the livestock industries. As the war progressed other factors also began to be felt, and labour, fuel and machinery shortages effectively prevented

expansion even when the relaxation of controls of acreage and the increased prices for wheat overseas might otherwise have encouraged increased production.

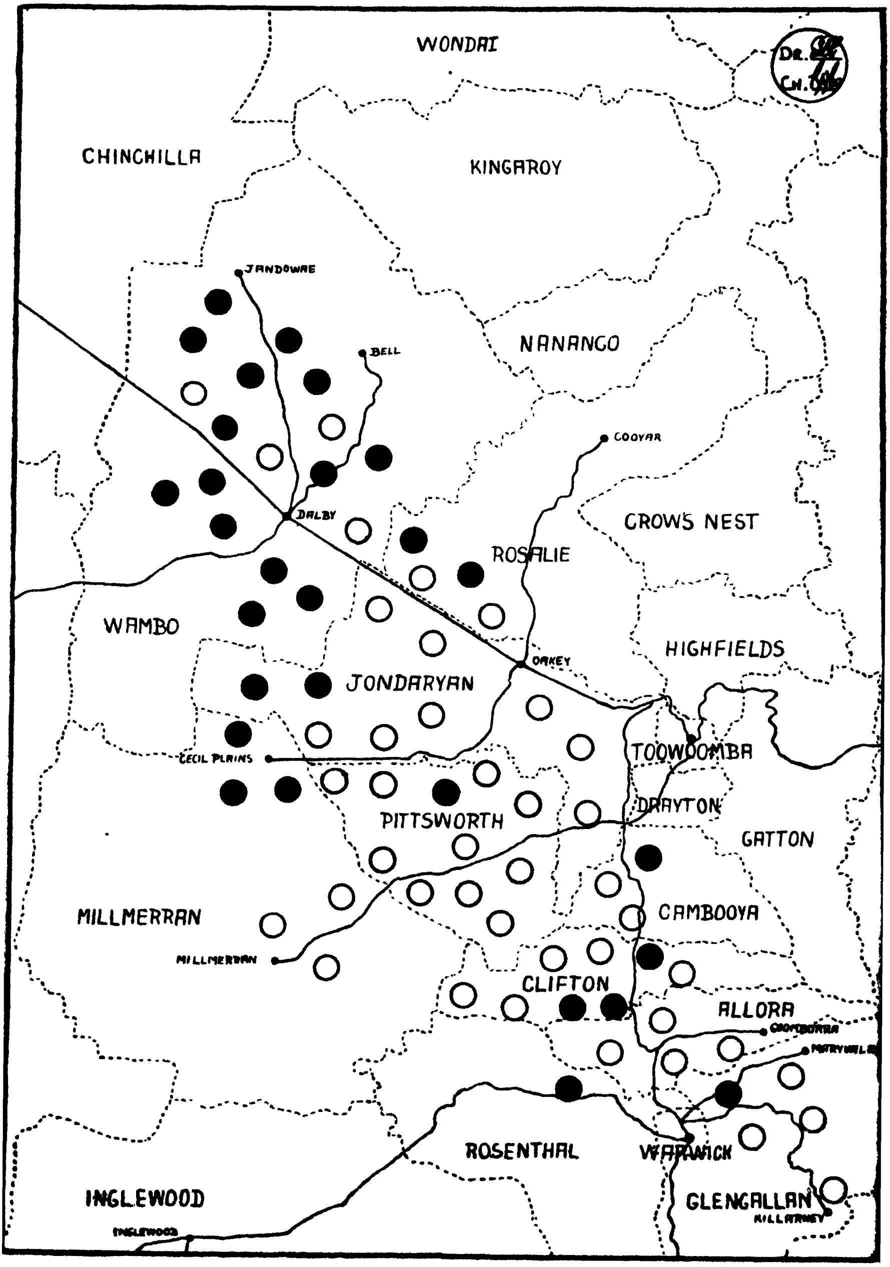


Plate 189.

WHEAT IN QUEENSLAND.—Chart illustrating the expansion of wheat growing in north-western Downs areas. Each circle represents 5,000 acres; the white circles represent acreages sown in the 1935-36 season and the black circles the additional acreages sown in the 1945-46 season.

The developments that have since taken place have brought the industry to a stage where Queensland will provide the 7-8 million bushels required for local consumption and also have a regular surplus of high quality grain available for export. Table 1 gives a further illustration of the trends outlined above.

TABLE 1.

WHEAT FOR GRAIN—QUEENSLAND.

Area, Production and Yield per Acre, 1920–21 TO 1948–49.

(*Source—Commonwealth Production Statistics.*)

Year.	Area.	Production.	Yield per Acre.
	Acres.	Bushels.	Bushels.
5 Year Average, 1920–21 to 1924–25	145,555	2,326,904	15·99
5 Year Average, 1925–26 to 1929–30	172,068	2,577,427	14·98
5 Year Average, 1930–31 to 1934–35	244,986	3,980,630	16·25
1935–36	239,631	2,690,316	11·23
1936–37	283,648	2,016,236	7·11
1937–38	372,935	3,749,443	10·05
1938–39	442,017	8,583,736	19·42
1939–40	362,044	6,794,906	18·77
1940–41	322,081	5,687,350	17·66
1941–42	290,801	3,079,898	10·59
1942–43	334,785	5,005,065	14·95
1943–44	281,302	5,084,292	18·07
1944–45	332,365	6,980,766	21·00
1945–46	392,502	8,187,687	20·86
1946–47	247,996 (*a*)	704,835 (*a*)	2·84 (*a*)
1947–48	462,239 (*a*)	10,684,563 (*a*)	23·11 (*a*)
1948–49	550,000 (*b*)	14,000,000 (*b*)	23·64 (*b*)

(*a*) Source—Queensland Government Statistician.
(*b*) Preliminary estimate—subject to revision.

Location.

Wheat production is mainly concentrated in the area known as the Darling Downs, with relatively smaller areas along the western line to Roma and an isolated area located in the Central District. What is of great significance, however, is the very marked transition, as mentioned earlier, that has taken place from the south-eastern Downs to the plains country of the north-western Downs. Plate 189 highlights the changes that have taken place on the Downs.

From Plate 189 it will be seen that there has been a degree of expansion over the whole wheat area but that the major emphasis has shifted to the north-west. Lately there has also been a substantial expansion in the areas further west toward Jackson and Dulacca, on the western Downs.

The influences that have made this transition possible are as follows:—

(*a*) Developments such as those relating to mechanisation and improved cultural and harvesting machinery, and the improved production technique thereby rendered possible;

(b) The breeding of suitable varieties for growing under Queensland conditions;

(c) The large tracts of land that became available when the prickly pear lands were cleared.

Mechanisation.

Wheat tends to be a hazardous crop under Queensland climatic conditions, and a major essential in wheat culture is rapidity of operation throughout the cultivation, seeding and harvest periods. Horses as a source of power are suitable only for small areas, particularly with the high temperatures that prevail, and it was not until mechanised power became available that the difficult climatic conditions could be overcome on large areas.

The predominance of summer rainfall has led to the adoption of a comparatively short fallow period during the summer months as distinct from the long fallows of the southern Australian wheat areas. Rapid destruction of weed growth during the summer months is aimed at in order to permit a suitable seed-bed to be established for the planting season from April to July. Moreover, with the comparatively light winter rains planting itself is usually carried out under considerable pressure of time.

For this to be satisfactorily accomplished the emphasis has at all times to be placed on speed of operation. The time factor is all-important and this has meant in effect that successful wheat farming on any large scale has been confined to the mechanised farm, which, of course, requires a sufficiently large area of wheat and/or other grains for worthwhile economic operation.

This phase of wheat growing has a significant bearing on the present expansionist stage of the industry. Speed of operation implies not merely mechanisation but the provision of sufficiently high-powered tractors to cope with the severe strain of continuous operation carried out under great pressure. The most serious tractor shortage of the war and post-war years has in fact been in just these high-powered machines that are required by the wheat industry in this State. Moreover, as the years go by with inadequate replacement of worn-out machines, the effort to carry out speedy cultivation suffers from the need to locate and fit spare parts and effect necessary repairs.

Thus, even now, expansion is being retarded to an incalculable extent by reason of the impossibility of obtaining sufficient suitable machinery for new areas and of obtaining the heavier types of tractor needed both for the replacement of old machines and for the speedy cultivation of increased areas on the individual farm.

Supplies of farm machinery other than tractors have improved of late years, but again shortages have influenced to some degree the extent of the possible expansion. Although it is quite impossible to measure the effect of such shortages it can safely be forecast that the ready availability of tractors of a suitable type and other farm machinery would result in a further impetus to wheat production.

Plant Breeding.

Many of the varieties introduced from other States in the early years were found unsuitable for Queensland conditions. Not until the release subsequent to 1920 of those varieties which resulted from the

work of Mr. R. E. Soutter, of the Queensland Department of Agriculture and Stock, were varieties available for general cultivation that were adapted to the peculiar climatic conditions in the man wheat areas. The question of wheat variety, together with its associated subject of wheat quality, is of particular importance to Queensland, and is dealt with in a later section.

Prickly-pear Lands.

Even with improved varieties and the advantages of mechanization, expansion could not have taken place without suitable land, and this was not available in quantity until the prickly-pear lands were freed as a result of the control of this weed by the caterpillar of the moth *Cactoblastis cactorum*. The destruction of this growth by Cactoblastis is said to provide the most dramatic and important example of biological control of weed growth in the world.

Captain Arthur Phillip is reported to have introduced prickly pear to Australia in 1788 from Rio de Janeiro in order to provide a dye for soldiers' coats from the cochineal insects with which the pear was infested. By 1901 the Queensland Government was offering a prize of £5,000, which was increased to £10,000 in 1907, to any person who could devise a means of eradicating the pest. By 1925 it was estimated that an area of 60,000,000 acres was densely infested with pear, of which 30,000 acres were useless from a production point of view.

Various methods of control, such as arsenical poisons and mechanical controls, were tried and some success was attained in small areas, but none effectively controlled the pear and prevented its spread to other areas until the advent of the caterpillar of the moth *Cactoblastis cactorum*. This was first introduced into Australia in 1912 by Mr. Henry Tryon, the then Government Entomologist. The moths were brought from La Plata, in Uruguay, but died before any knowledge was obtained as to their value, and were not reintroduced until 11 years later.

Experiments were conducted with these insects at a field station at Chinchilla, and in 1926 it became apparent that a solution to the problem might be in sight. A total of two billion eggs was released through official sources in Queensland between 1929 and 1930. The rapid destruction of the pear was followed by the virtual dying out of the moth because of the vanished food supply and regrowth of prickly pear took place very rapidly. By 1934, however, it was obvious that the insect had the capacity to build up its population faster even than the pear and it definitely gained the ascendency, which it has maintained ever since.

Much of this land was heavily timbered, mainly by brigalow and belah scrubs or eucalyptus forests, but when cleared, fenced and watered it was found to be highly productive for both pastoral and agricultural purposes.

[TO BE CONTINUED.]

ASTRONOMICAL DATA FOR QUEENSLAND.

JULY, 1949.

Supplied by W. J. Newell, Hon. Secretary of the Astronomical Society of Queensland.

TIMES OF SUNRISE AND SUNSET.

At Brisbane.			MINUTES LATER THAN BRISBANE AT OTHER PLACES.					
Day.	Rise.	Set.	Place.	Rise.	Set.	Place.	Rise.	Set.
	a.m.	p.m.						
1	6.39	5.03	Cairns	8	50	Longreach	26	43
6	6.39	5.05	Charleville ..	25	29	Quilpie	37	33
11	6.39	5.07	Cloncurry	36	63	Rockhampton ..	0	19
16	6.38	5.10	Cunnamulla ..	32	27	Roma	15	19
21	6.38	5.12	Dirranbandi ..	22	16	Townsville ..	8	42
26	6.34	5.15	Emerald	11	28	Winton	29	52
31	6.31	5.17	Hughenden ..	21	49	Warwick	5	4

TIMES OF MOONRISE AND MOONSET.

At Brisbane.

Day.	Rise.	Set.
	a.m.	p.m.
1	10.23	10.01
2	10.57	11.05
3	11.31	..
	p.m.	a.m.
4	12.04	12.08
5	12.40	1.12
6	1·19	2.17
7	2.04	3.23
8	2.55	4.30
9	3.52	5.34
10	4.52	6.33
11	5.54	7.25
12	6.55	8.09
13	7.53	8.47
14	8.48	9.20
15	9.42	9.49
16	10.34	10.16
17	11.25	10.44
18	..	11.11
	a.m.	
19	12.18	11.40
		p.m.
20	1.13	12.12
21	2·10	12.50
22	3.09	1.34
23	4.10	2.25
24	5.10	3.24
25	6·06	4.28
26	6.57	5.36
27	7.42	6.45
28	8.21	7.51
29	8.58	8.57
30	9.32	10.01
31	10·06	11.05

MINUTES LATER THAN BRISBANE (SOUTHERN DISTRICTS).

Charleville 27; Cunnamulla 29; Dirranbandi 19;
Quilpie 35; Roma 17; Warwick 4.

MINUTES LATER THAN BRISBANE (CENTRAL DISTRICTS).

Day.	Emerald.		Longreach.		Rockhampton.		Winton.	
	Rise.	Set.	Rise.	Set.	Rise.	Set.	Rise.	Set.
1	14	23	30	39	5	14	34	44
6	27	13	43	28	18	3	50	31
11	29	10	45	24	20	0	52	27
16	19	19	35	34	10	10	39	39
21	12	28	27	43	1	19	29	52
26	11	28	26	43	0	19	28	51
31	21	15	38	31	12	6	43	35

MINUTES LATER THAN BRISBANE (NORTHERN DISTRICTS).

Day.	Cairns.		Cloncurry.		Hughenden.		Townsville.	
	Rise.	Set.	Rise.	Set.	Rise.	Set.	Rise.	Set.
1	19	37	42	56	27	41	17	32
3	31	31	51	51	35	35	25	26
5	43	18	59	43	44	27	36	17
7	52	7	64	35	50	21	43	8
9	56	2	68	32	52	17	46	3
11	53	4	67	33	50	19	44	5
13	43	12	60	38	45	24	36	12
15	34	22	53	45	38	30	28	19
17	24	32	46	53	31	38	21	28
19	19	41	42	58	27	44	17	35
21	9	50	37	63	21	49	8	42
23	3	56	34	67	18	53	4	46
25	3	53	34	66	18	51	4	44
27	11	44	38	60	23	46	10	37
29	23	32	46	53	30	38	20	28
31	34	20	54	44	38	29	29	18

Phases of the Moon.—First Quarter, 3rd July, 6.08 p.m.; Full Moon, 10th July, 5.41 p.m.; Last Quarter, 18th July, 4.01 p.m.; New Moon, 26th July, 5.33 a.m.

On 2nd July the Earth will be at its greatest distance from the Sun—94,600,000 miles. On the 15th it will rise and set approximately 25 degrees south of true east and true west respectively, and on the 16th and 30th the Moon will rise and set very close to true east and true west respectively.

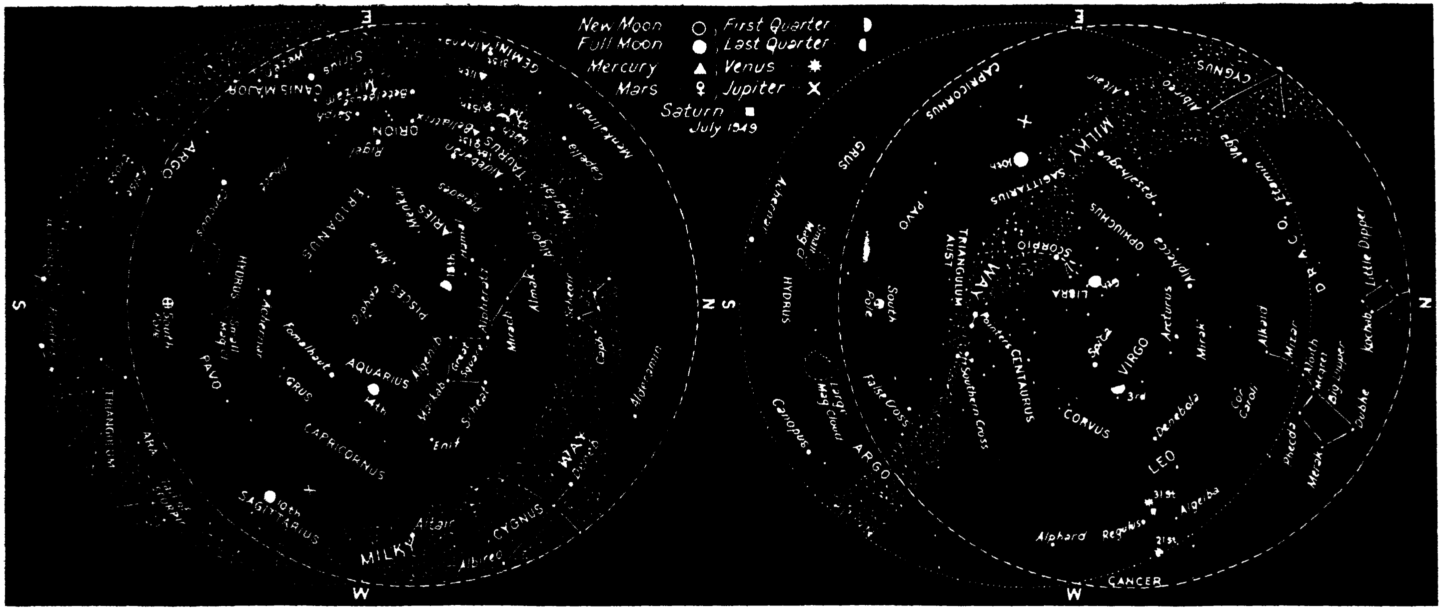
Mercury.—A morning object until the later part of the month. On the 1st, in the constellation of Taurus, it will rise 1 hour 40 minutes before the Sun and will be in line with the Sun on the 26th. By the end of the month it will set 20 minutes after sunset.

Venus.—In the constellation of Cancer, at the beginning of the month will set 1½ hours after the Sun. By the end of the month it will be in the constellation of Leo and on the 31st will pass less than 1 degree to the south of Saturn, when it will set 2 hours 8 minutes after the Sun.

Mars.—Now rising an hour or two before the Sun, it is observable in the east during morning twilight. On the 1st it will rise 1½ hours before the Sun and on the 31st, in the constellation of Gemini, will rise about 2 hours before the Sun.

Jupiter.—Now in the constellation of Sagittarius, will be favourably placed for observation during the month; on the 1st rising in the east 1 hour before the Sun sets in the west and on the 31st rising during the daylight hours.

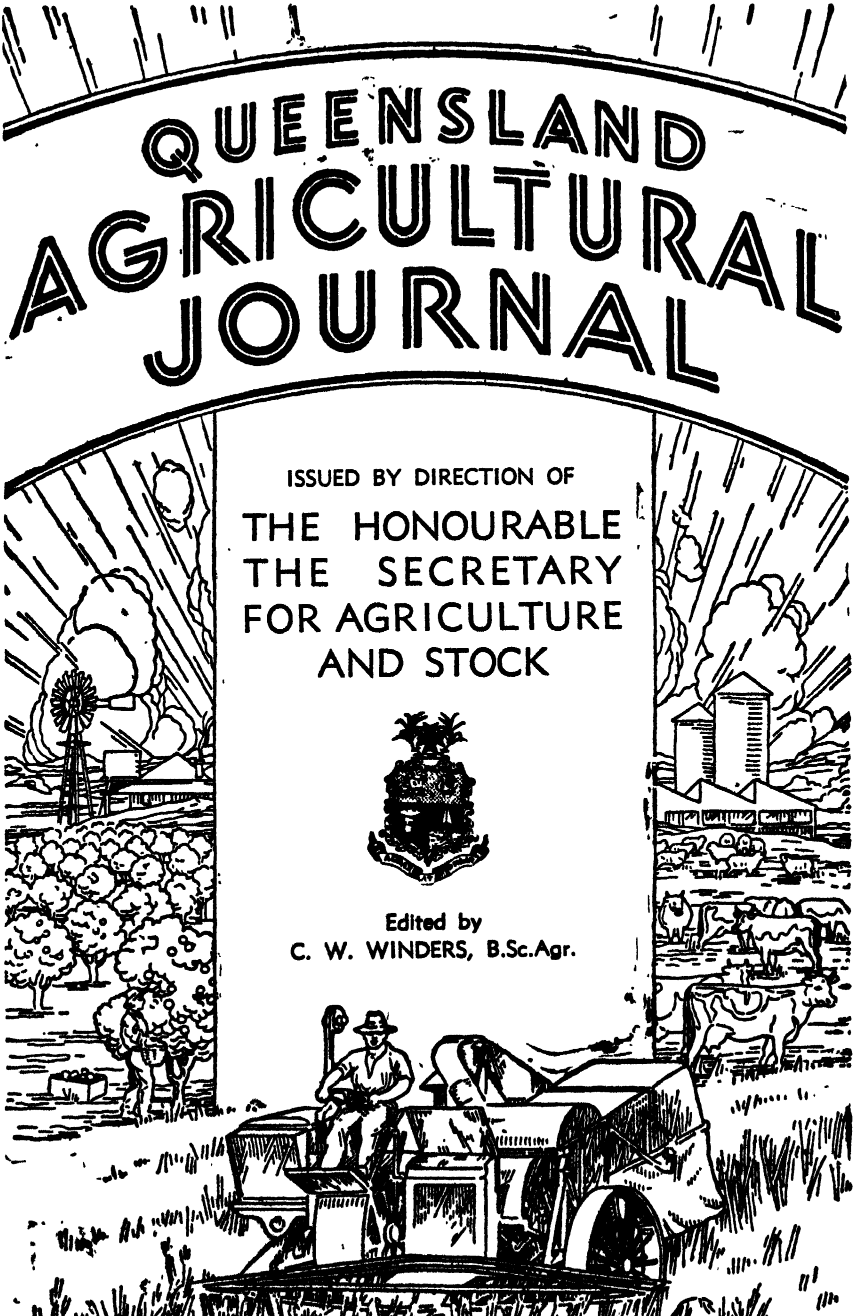
Saturn.—In the constellation of Leo, now well to the west at sunset. On the 1st it will set between 10 p.m. and 11 p.m. and on the 31st between 7.15 p.m. and 8.30 p.m.



Star Charts.—The chart on the right is for 7.15 p.m. in the south-east corner of Queensland to 8.15 p.m. along the Northern Territory Border on the 15th July. (For every degree of Longitude we go west the time increases by 4 minutes.) The chart on the left is for 10 hours later. On each chart the dashed circle represents the horizon as viewed from Cape York and the dotted circle is the horizon for places along the New South Wales Border. When facing north hold "N" at the bottom; when facing south hold "S" at the bottom, and similarly for the other directions. Only the brightest stars are included and the more conspicuous constellations named. The stars, which do not change their relation to one another, moving east to west, arrive at any selected position about 4 minutes earlier each night. Thus, at the beginning of the month the stars will be in the positions shown about 1 hour later than the time stated for the 15th and at the end of the month about 1 hour earlier than that time. The positions of the Moon and planets, which are continually changing in relation to the stars, are shown for certain marked days. When no date is marked the position is for the middle of the month.

Supplement to the "Queensland Agricultural Journal," February, 1950.

Volume 69



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Contents

Agriculture on the Darling Downs.

J. HART, Adviser in Agriculture.

THE Darling Downs (Plate 1), to the west of the main Dividing Range, is a stretch of very fertile, mainly open plain country covering an area of about 5,625 square miles, most of which is freehold tenure. The greater part of the 3½ million acres which comprises this well known tract of country is suitable for cultivation.

An obelisk to the memory of Allan Cunningham has been erected at Cunningham's Gap, a break in the Main Range through which this botanist-explorer passed when he discovered the Darling Downs in 1828. The first station on the Downs was taken up in 1840 and in 1842 the area was thrown open for general settlement and pastoralists gradually occupied the area. Some cultivation was practised, but these pastoral holdings were devoted mainly to pastoral pursuits for many years and it was not until the dawn of the 20th century that agricultural development really expanded. One by one, the larger holdings have been subdivided. To complete this process, the few remaining large holdings are now being split up for closer settlement under the War Service Land Settlement Scheme.

During the years 1930-33 the Downs entered one of the most important phases of its development. Two outstanding changes which contributed to this development were, firstly, the introduction of *Cactoblastis cactorum* to effectively combat prickly pear, which prior to 1930 occupied extensive tracts of country in this area, and secondly, the expansion of the wheatgrowing industry in the Dalby district, which centre now grows one-third of the State's wheat crop.

To-day, the Darling Downs is the most important agricultural area in Queensland, for in addition to producing the bulk of the State's grain harvest it supports a large dairying industry and an ever-increasing fat lamb and cattle industry.

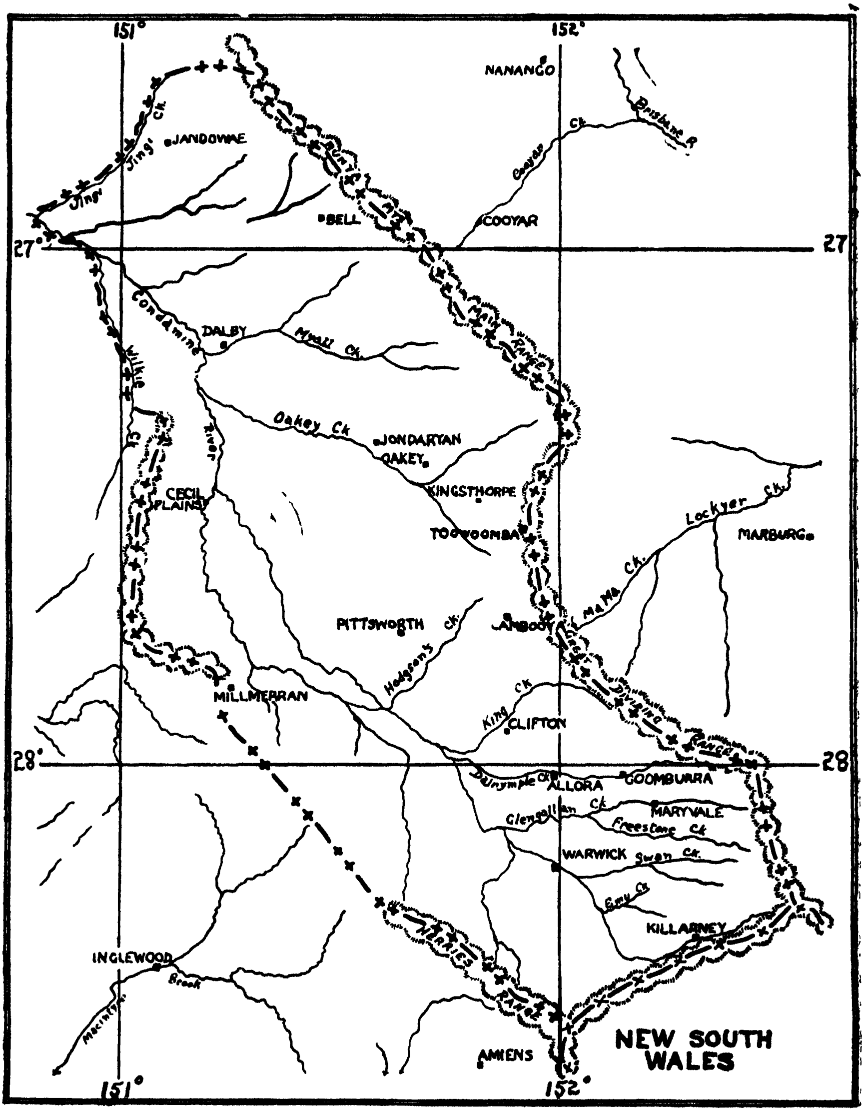


Plate 1.
SKETCH MAP OF THE DARLING DOWNS.

CLIMATE.

Table 1 gives meteorological data for Toowoomba, Dalby, Warwick and Pittsworth.

TABLE 1.

METEOROLOGICAL DATA FOR DARLING DOWNS CENTRES.

*	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Year.
						Toowoomba.							
a ..	81·6	80·5	77·8	73·7	67·1	61·8	61·1	64·5	70·8	76·1	80·4	82·5	73·2
b ..	60·7	60·9	58·3	52·5	46·2	42·5	40·2	41·6	46·9	51·8	56·4	59·5	51·5
c ..	506	451	381	254	219	252	203	169	214	257	319	431	3,656
						Dalby.							
a ..	89·3	88·7	85·6	80·3	73·1	67·2	66·3	70·0	76·3	82·9	87·8	89·7	79·8
b ..	64·3	63·9	60·5	53·8	46·1	42·3	39·4	41·0	47·9	54·6	60·2	63·9	53·2
c ..	332	284	276	133	130	171	172	123	168	200	266	321	2,577
						Warwick.							
a ..	85·2	84·4	81·2	76·6	69·6	64·1	63·3	66·4	73·1	78·7	83·8	86·1	76·8
b ..	62·6	62·4	58·9	52·3	44·2	40·5	37·5	38·5	43·9	51·1	57·4	60·9	50·1
c ..	355	313	356	164	154	180	182	151	180	229	255	340	2,759
						Pittsworth.							
a ..	85·7	84·7	81·8	76·5	68·5	62·8	61·6	65·4	72·4	78·9	84·1	85·8	75·7
b ..	62·4	61·7	59·2	53·8	47·0	43·5	41·2	42·8	48·2	53·6	58·6	61·2	52·8
c ..	387	315	319	152	143	185	177	124	166	216	270	349	2,803

*a = mean maximum temperatures; b = mean minimum temperatures; c = average rainfall in points.

The mean maximum and minimum temperatures for Toowoomba, Dalby, Warwick and Pittsworth are based on 25, 24, 24 and 25-year records, respectively, and rainfall averages on 59, 61, 61 and 44-year records, respectively.

Whilst other meteorological information would be required to give a complete picture, the table gives some indication of the climatic conditions experienced on the Darling Downs. The figures, however, give an exaggerated picture of climatic reliability and uniformity. Storm rains, which provide about half the annual rainfall during the summer months (November to March), are most unreliable and it is not unusual for the whole of the Downs to receive little or no rain for periods ranging from 6 to 10 weeks during these months. Heat waves often accompany these dry spells.

The winter rainfall, usually of a more general nature than the summer rainfall, is similarly unreliable.

SOILS AND VEGETATION.

For convenience of discussion, the Darling Downs is divided into three main areas, each being more or less confined to particular soil types. These areas are as follows:—

1. *The Eastern Downs* (Plates 2–4):—This contains two subdivisions:—

   (*a*) The undulating and hilly country of the eastern and north-eastern portion, typified by open eucalyptus forest and black soils.

   (*b*) The undulating country of the Toowoomba district and the extreme north-eastern fringe of the Downs, typified by open eucalyptus forest and red loam soils.

Plate 2.
SWAN VALLEY AT HERMITAGE, NEAR WARWICK.—Note the absorption banks, sown to Rhodes grass, to protect the lower slopes from erosion.

Plate 3.
WHEATFIELDS AT CHARLTON, NEAR TOOWOOMBA.

Plate 4.
SHEET EROSION ON A CULTIVATED FIELD NEAR ALLORA, EASTERN DOWNS

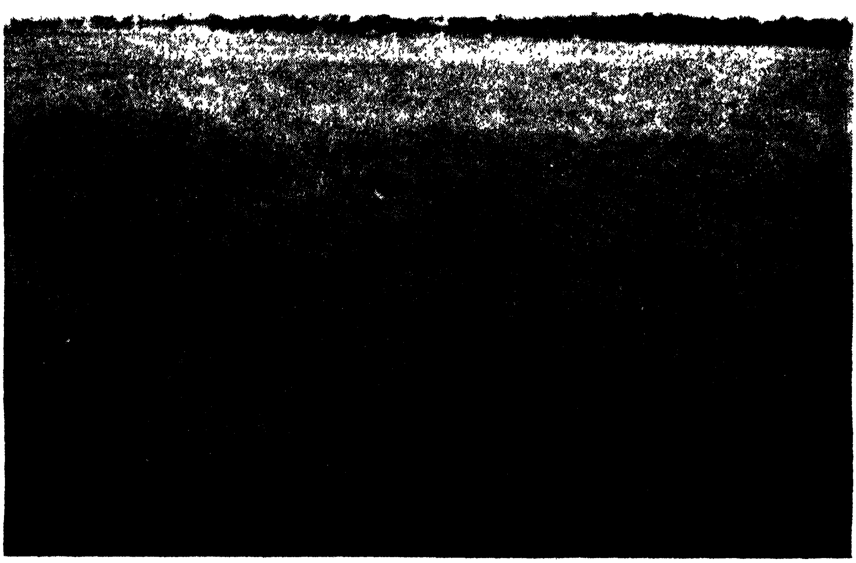


Plate 5.
OPEN GRASSED PLAIN ON THE NORTH-WESTERN PORTION OF THE DOWNS BETWEEN DALBY AND BELL.

Plate 6.

OPEN FOREST COUNTRY ON THE NORTH-WESTERN PORTION OF THE DOWNS BETWEEN DALBY AND BELL.

2. *The Downs Proper.*—Open, treeless, blue grass plains; self mulching black earths.

3. *The Western Downs*:—This area contains two definite regions:—

(*a*) The brigalow-belah association of the west and north-western Darling Downs.

(*b*) Open poplar box forests of the Dalby and northern districts.

The major portion of the Darling Downs is, as the name suggests, flat and featureless open plain country, broken on occasions by rocky outcrops. The deep black soil was formed under a grassland vegetation subjected to conditions of summer rainfall and winter drought. Such conditions have given rise to a soil moderately high in organic matter and well supplied with the major mineral plant foods—lime, phosphate and potash. Under natural conditions, this soil has a well-developed structure, while the surface is self mulching, friable, and in spite of its heavy texture fairly permeable to water. These soils, owing to their high clay content, have a very good moisture retaining capacity. Deep, black soils occur in other parts of the world where climatic conditions are similar to those of the Darling Downs, such areas constituting the principal grain-producing soils of the world; the famous "black earths" of Russia are an example.

This open grassland country, where Queensland blue grass (*Dichanthium sericeum*) and pitted blue grass (*Bothriochloa decipiens*) now predominate, is for the most part devoid of trees, narrow leaf ironbark (*Eucalyptus crebra*) and silver leaf ironbark (*Eucalyptus melanophloia*) being found only on the low rocky outcrops that occur at infrequent intervals throughout the region.

A similar black-soil type occurs on the undulating and hilly country of the eastern and north-eastern Downs overlying basaltic parent material. This soil, though deep according to usual standards, has a shallower profile than the open downs soils. It is well supplied with plant foods, though in some cases to a lesser degree than the soil of the open plain country. This undulating and hilly portion of the Darling Downs is mostly open forest country carrying smooth-bark trees or gums interspersed with box and stringybark (*Eucalyptus* sp.).

The extreme eastern and north-eastern fringe of the Darling Downs is characterised by a red, loamy soil formed from basalt and deriving its red colour from the free iron oxide formed during the process of weathering. This soil type is far less extensive than those previously mentioned, but is nevertheless quite important from an agricultural viewpoint The soil is free working and permeable and with a fairly high level of fertility, though inferior to the black earths in both fertility and moisture holding capacity.

Towards the north-western portion of the Downs the open grasslands are replaced by open eucalyptus forest, poplar box (*Eucalyptus populifolia*) being the predominant species. The soil of this association is a type of black earth, but the surface soil though heavy is of a slightly lighter texture and of lower fertility than the more typical black earths of the true downs country. In the natural state, the structure of this soil is only moderately well developed, though under cultivation it is found to mulch fairly readily. Over-all, this soil compares favourably with the more fertile black earths of the open plain country to the south-east.

Stands of relatively dense timber, comprising chiefly brigalow (*Acacia harpophylla*) and belah (*Casuarina lepidophloia*) and occurring mostly in the north and north-west of the Darling Downs, are associated with a class of soil similar in many respects to that of the open downs but different in that the subsoil, at depths of 3–4 feet, is a stiff, grey clay not readily permeable to water. It is probable that these soils have developed in areas where drainage within the soil has been restricted because of changes in the local topography.

A further soil type of relatively minor importance may be found at intervals throughout the heavier black earths. This is a soil formed from light-textured parent material and as a consequence is of a definite sandy nature; it is described as a red-brown earth. It is a loamy soil, moderately fertile and well supplied with lime in the deeper subsoil. This soil can be found on the slightly more elevated portions of the Downs, particularly in the Oakey district. Being more sandy in texture, it is less fertile than the black earths, has an inferior moisture retaining capacity, and accordingly requires more special management for crop production.

Fertilizers and other soil amendments are not used to any great extent in the production of crops on the Darling Downs soils, but some interest is being shown in the use of superphosphate, particularly in the Warwick district.

Soil erosion, especially during the high intensity summer storm rains, is a serious problem in the area defined as the Eastern Downs (see Plate 4), much of which consists of sloping land. Clean cultivation and bare fallowing through the summer months have contributed in a large measure to this problem. Many acres will become useless for cultivated crops unless erosion can be checked. It is strongly recommended that farmers avail themselves of the services of the Department of Agriculture and Stock in combating this menace.

It is indeed fortunate that the valuable open plain country, which is also bare fallowed over the summer months of storm rains, is not subject to water erosion to the same extent as the Eastern Downs country.

WATER FACILITIES.

Natural watercourses such as creeks and rivers play a very minor part in the provision of water for stock and irrigation purposes on the Darling Downs. Good sub-artesian supplies are available over the whole area, but in very few instances is the supply sufficient to permit pumping for irrigation. The depth at which water is available varies from 50 feet to 400 feet, approximately. The shallow supplies are generally found on the open plain country, where the water, though satisfactory for stock, is mostly unsuitable for irrigation. Before being used extensively for irrigation, water from bores and wells should first be submitted for analysis to determine its suitability or otherwise for this purpose.

PASTURES.

These may be broadly divided into (*a*) native pastures and (*b*) sown pastures.

Native Pastures.

Queensland blue and pitted blue grasses are the predominant species whilst love grasses (*Eragrostis* species), kangaroo and oat grasses (*Themeda* species), Flinders grasses (*Iseilema* species), native millets (*Setaria* species), and species of *Sporobolus* form a minor part of the native grass association. Legumes, especially burr medic (*Medicago denticulata*) in the winter and spring, and other herbage are important constituents.

The pasture plants, though generally nutritious, are mainly summer growing and do not withstand intensive grazing. If heavy and continuous stocking is practised, many of the species are replaced by the inferior pitted blue grass. Such conditions have led agriculturalists to investigate the possibilities of sown pastures.

Sown Pastures.

None of the sown pasture species available in Australia is particularly suited for permanent pasture on the Eastern Downs or the Downs proper.

Rhodes grass (*Chloris gayana*) is most commonly selected for sown pastures, being found mostly in the brigalow-belah country, where it forms the principal fodder in the Western Downs dairying districts. After the scrub has been felled and allowed to stand until such time as all suckers have been destroyed, the area is fired and then sown to Rhodes grass. A Rhodes grass-lucerne mixture is preferable to the pure grass stand and the sowing of 8 lb. Rhodes grass with 1 to 2 lb. of lucerne is recommended.

Urochloa (liverseed) grass (*Urochloa panicoides*) has been used as a summer pasture in some areas—mainly in the Eastern Downs areas—but this grass is not entirely satisfactory, requiring good rains to stimulate and maintain reasonable growth.

Other grasses which have been tried, particularly for winter fodder, are prairie grass (*Bromus unioloides*) and Toowoomba canary grass (*Phalaris tuberosa*). These, though still being persevered with in some quarters, are not recommended for this area.

Plants which are sometimes weeds of cultivations are of importance in pastures. These mostly comprise various legumes—particularly clovers and trefoils—and numerous species belonging to such plant families as the Chenopodiaceae, Amarantaceae and Malvaceae. Burr medic, in particular, is a very useful constituent of the pastures in winter and spring.

[TO BE CONTINUED.]

SOIL AND WATER ANALYSES

★ ★

Attention of producers is drawn to the fact that the following analyses are carried out, free of charge, by the Department of Agriculture and Stock:—

1. Soil samples for fertility measurements;
2. Water samples to determine their suitability or otherwise for irrigation or stock use.

Unfortunately, in the past, many samples have been submitted which were valueless, either because they were incorrectly taken or were too small in quantity. **It is essential therefore that the information hereunder be strictly followed.**

SOIL SAMPLE

When analysing soil it is essential that details of the history of the area of ground in question be known. In addition, samples should be taken according to a set pattern. Therefore, when an analysis is desired, a request for instructions as to the correct method of taking samples of soil should be forwarded to the Department of Agriculture and Stock, William Street, Brisbane.

WATER SAMPLE

Samples of water should be taken, in the case of established wells or bores, after the pump has been running for some time. The bottle (same capacity as a beer bottle) to be used for taking the sample should be well washed and then rinsed out several times with the water to be tested before being filled. About 1 inch air space only should be left between the cork and the water.

In all cases, covering letters should accompany samples which should be marked clearly with the sender's name and address and forwarded to the Department of Agriculture and Stock, William Street, Brisbane.

PLANT PROTECTION

Tomato Diseases and Their Control.

J. E. C. ABERDEEN (Formerly Pathologist, Science Branch).

(*Continued from page 344 of June issue.*)

FUSARIUM WILT.

THE first indication that a plant is infected with Fusarium wilt is given by a cessation of growth but this symptom frequently passes unobserved. The next symptom is provided by the leaves, for those near the base of the plant commence to turn yellow and die. Then, a week to a month later, according to whether temperatures are high or moderate, the entire plant becomes wilted. Sometimes the infected plant does not die but remains in a stunted state for several months.

Plate 7.

FUSARIUM WILT.—In the affected stem on the left the brown streaks in the woody water-conducting tissue are evident.

Further features of Fusarium wilt infection are that a diseased leaf readily breaks away from the stem, and, if the bark is stripped off the plant just above the ground level, brown streaks will be seen in the woody water-conducting tissue (Plate 7). In severe cases the dark streaks extend around the entire stem, so that if the stem is cut across with a sharp knife a dark, narrow ring shows up just inside the bark. A further characteristic feature is that often only one branch of the plant is infected. In such a case, if the growing period is entering the cooler part of the year, the plant may produce a number of healthy branches and a payable crop still be harvested.

This disease is caused by a fungus (*Fusarium bulbigenum lycopersici*) which penetrates the roots and grows up through the water-conducting vessels of the stems and leaf stalks, causing interference with the passage of water through the plant. This blockage, together with the action of a poisonous substance produced by the fungus, causes wilting. The fungus also occasionally grows from the stem into the developing fruit and infects the seed.

The fungus is usually introduced to a farm with the seed and carries over from season to season in the soil. The disease may be spread by soil washing across lower slopes, by ploughs or other implements, or by moving the residue of an infected crop on to an uninfested area prior to destroying it.

This disease requires warm temperatures, with an optimum of 80°–90° F., for its development and consequently only affects plants growing during the spring and summer months. Light-textured soils tend to produce a greater incidence than heavy soils, and an acid soil also accentuates the trouble.

Fusarium wilt is present in practically every warm-temperate, subtropical and tropical tomato-growing area in the world. In Queensland it is still a limiting factor for summer crops, and any soil which has grown tomatoes for a number of years may be assumed to be infected with the Fusarium wilt organism.

Control.

The main line of control for Fusarium wilt is to use "resistant" varieties. It should be understood, however, that the term "resistant variety" is really a relative one and under conditions very favourable to wilt most of these varieties show a high percentage of infection. The outstanding variety for resistance to this wilt is Pan-America, but as it sets such a light crop under Queensland conditions it cannot be recommended for commercial use. Suitable so-called resistant varieties are Rutgers, Break o' Day, Valiant, Red Marhio, Pritchard, Pearson and Marglobe among the larger-fruited varieties; and Marvana, Sensation, Australian Earliana, Walker's Recruit and Potentate from the smaller-fruited types. Salads Special, Sioux and Grosse Lisse possess some measure of resistance, but probably not as high as Rutgers, and would be best included with the susceptible varieties. Among the definitely susceptible varieties are Chalk's Early Jewel, Bonny Best, Rouge de Marmande, Earliwinner and Earliana.

Subsidiary control measures, such as careful selection of seed-bed site and the destruction of diseased plants by burning after the crop is finished, are again strongly recommended.

VERTICILLIUM WILT.

The symptoms of Verticillium wilt are very similar to those already described as characteristic of Fusarium wilt, both in the manner of wilting of the affected plants and in the discolouration of the water-conducting vessels. This disease, however, only shows up in the winter and the older leaves of attacked plants tend to dry and wither without the preliminary yellowing which is characteristic of Fusarium wilt. There is also a tendency for the vascular darkening to occur only in the base of the stem. The diagnosis is often further complicated by the fact that some Fusarium infections may carry over into winter following their initiation the previous autumn, so that both Fusarium and Verticillium infections are present in the same crop.

This disease is caused by a fungus (*Verticillium albo-atrum*). Since it is restricted in its activity to the coldest months of the year, the variety which is most frequently attacked is Salads Special. While the trouble is widely distributed it is of economic importance only in the Brisbane-Redlands district.

Control.

The only control measures which can be recommended for dealing with Verticillium wilt are crop rotation and the use of healthy seed. No varieties which are resistant to the disease can be recommended because, though at least one (Riverside) is resistant, it does not set fruit freely in winter time. It must be assumed that the organism is present in the soils of most of the older tomato farms in the districts where it is important.

BACTERIAL WILT.

The first symptom of bacterial wilt infection is a slight stunting of the attacked plant, but the symptom which is generally noticed is the spectacular collapse of what appears to be a vigorously-growing healthy plant (Plate 8). This collapse may be complete within 24 hours and may show no preliminary symptoms on the lower leaves; in this respect it differs from Fusarium wilt. The water-conducting vessels under the bark are often discoloured, as in the latter disease, but when the stem of a bacterial wilt infected plant is cut across just above soil level a slimy ooze is often, but not always, apparent. It is never present in Fusarium wilt.

Bacterial wilt is caused by a bacterium (*Xanthomonas solanacearum*) and in this respect it differs from the two previously discussed wilts, both of which are the result of fungous infection. It appears, however, to be very localised in its occurrence; for example, in one large district only portions of individual farms are affected. The tendency is for the lower and moister portions of the properties to show the greatest incidence of the disease. Unlike Fusarium wilt, bacterial wilt is favoured by alkaline soils. The soil may receive its primary contamination from infected seed, but it is possible that virgin soil may be infested. Like Fusarium wilt, this disease occurs only in warm weather, the most favourable temperature being approximately 75° F. It also is carried over from one season to another in the soil.

Plate 8.

BACTERIAL WILT.—The collapse of the plant is shown.

Bacterial wilt occurs in most tomato-growing countries and has been recorded from the majority of the tomato-growing areas in Queensland. It is only of economic importance to the late summer crops of tomatoes. The disease may also attack potatoes, eggplants and tobacco, so the presence of these crops on a farm may accentuate its occurrence.

Control.

Soil treatment with sulphur has been successfully employed in the United States of America for dealing with this disease, but tests of this control measure have given only partial success in Queensland. Therefore, it is not at present considered that the adoption of this treatment is warranted under Queensland conditions. So far as resistant varieties are concerned, the only commercial variety that has shown any degree of resistance to bacterial wilt is Sensation. This variety has several disadvantages. It needs to be trellised and pruned to develop fruit of reasonable size and also has a distinct tendency towards puffy fruit. Break o' Day, Marglobe and similar varieties are extremely susceptible to the disease.

It would appear, therefore, that losses due to bacterial wilt may best be minimised by the adoption of seed selection and disinfection and by refraining from growing crops of tomatoes on infected soil during the warmer months of the year.

DAMPING OFF.

The first indication of this disease is patches of several seedlings in the seed-bed lying flat on the soil. A further characteristic is that the leaves and stem of the seedling at the time of the collapse are still quite green, turgid and healthy. If the root is carefully dug up and the plant examined, a small water-soaked area will be noticed on the stem at what was the soil level, and it is at this point that the seedling has collapsed.

The disease is caused by several fungi, of which a *Pythium* is probably the commonest The fungi may be present in any unsterilized seed-bed and usually attack the plants in their early stages—that is, prior to the development of the first true leaves. After the plant is "hardened," damping off rarely causes trouble.

The disease is aggravated by wet, shaded conditions.

Control.

If the disease is consistently present, then the following precautions will be necessary:—

(i.) Seed treatment;

(ii.) Sterilization of the seed-bed soil;

(iii.) Improved control of growing conditions;

(iv.) Chemical treatment of the seed-bed after the seedlings have emerged.

Under average conditions, however, special precautions are not required. Seed treatment should be already practised as a routine measure. Sterilization of the seed-bed soil need not be emphasized unless the disease or some other seed-bed disease is consistently present. Further details on this subject are given in the section on "Care and Management of the Seed-bed." The main emphasis must be placed on the control of growing conditions and the essential point is to avoid excessive moisture lying in the seed-bed. This may be achieved by good drainage, a sunny location, planting seed in rows and careful watering (such as avoiding very frequent light waterings which maintain a film of free moisture on the surface of the bed).

If damping off does appear, it is advisable to dry out the bed as far as practicable and apply a chemical treatment. Suitable chemical treatments are with Cheshunt mixture, potassium permanganate (Condy's crystals) or one of the copper sprays.

Cheshunt mixture is made up according to the following formula:—Finely-powdered bluestone (copper sulphate) 2 parts by weight and fresh finely-powdered rock ammonia (ammonium carbonate) 11 parts by weight are thoroughly mixed and stored in a tightly-stoppered glass or earthenware vessel for at least 24 hours before use. One ounce of this dry mixture is dissolved in 2 gallons of water and sufficient used to wet the bed thoroughly.

Condy's crystals at the rate of 1 oz. to a gallon is a convenient substitute.

If using one of the copper sprays, it is made up at the same strength as for spray application and watered on the bed as above.

MOSAIC.

There are probably at least two different virus diseases which are grouped under this title and up to the present no attempt has been made to clearly differentiate them in the mind of the tomato-grower in Queensland. They are the common tomato mosaic and the tomato aucuba (or yellow) mosaic. Owing, however, to the fruit losses in some districts from what is apparently the aucuba form, separate descriptions of these diseases are given below.

Common mosaic of the tomato is identical with the disease of the same name which occurs on tobacco and may infect a large number of plants in the same family—for example, wild gooseberry, wild chili and black-berried nightshade—and is intertransmissible with these hosts. Affected plants in general are lighter green in colour than is normally the case in healthy tomatoes, and their foliage is slightly crinkled. A close examination of mosaic-infected plants also shows their leaves to be mottled with indefinite light and dark-green areas. Fruiting on such plants may not be appreciably affected by the presence of the disease when it is acquired late in the life of the plant, but if the plant is infected early the yield loss from mosaic can be serious, even if the disease is due to a form that is apparently mild in its effect on the vegetative growth.

Plate 9.

AUCUBA MOSAIC.—The mottling and distortion of the affected leaf on the right is seen in comparison with a healthy leaf on the left.

Mosaic is extremely infectious and is readily spread by the hands and by pruning knives, and to some extent by aphids. A proved source of infection is from the hands of tobacco smokers.

Aucuba (yellow) tomato mosaic is far more severe in its effect. The mottling produced varies in colour from yellow to dark-green and the actual distortion of the leaves is more accentuated then in common mosaic (Plate 9). Also, the fruits are often marked by yellowish rings and blotches. These blotches are more noticeable after the fruit colours, and have resulted in market condemnations of almost entire consignments. The transmission of this disease is the same as for common mosaic.

FERN-LEAF.

After a tomato plant has become infected with the virus causing this trouble, the first symptoms to appear are thickening and rolling of the leaf edges. At a later stage the terminal shoots become a mass of very narrow, distorted leaflets, all with thickened and curled edges, and if any fruit is borne by such plants it is malformed (Plate 10).

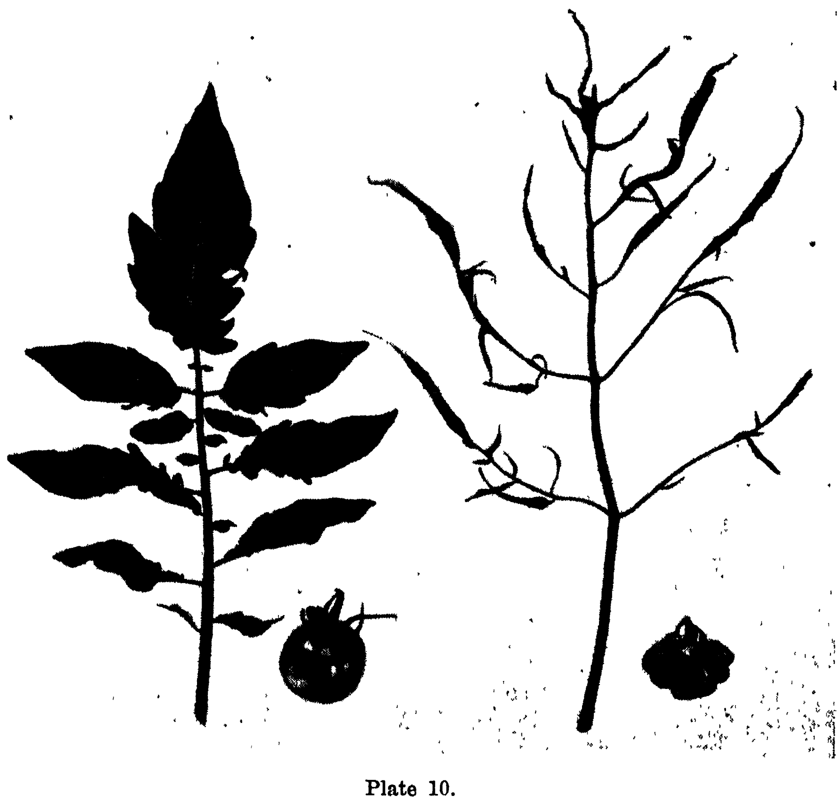


Plate 10.
FERN-LEAF.—Showing affected leaf and fruit in comparison with healthy leaf and fruit.

The virus causing this disease can infect a very wide range of species, including many common garden and crop plants. It causes cucumber mosaic and heart rot of bananas and is commonly known as the cucumber mosaic virus. Tomato mosaic virus may produce somewhat similar symptoms under certain conditions but it is thought that most of the fern-leaf seen in this State is due to the firstmentioned.

STREAK.

The least common of the tomato virus diseases in Queensland is the one called streak, regarding which little is known in this State. Elongated, slightly sunken greyish-black streaks or spots on the stem are characteristic of this virus disease, which may also produce lines on the leaf and brown irregular markings on the surface of the fruit.

CONTROL OF MOSAIC DISEASES, FERN-LEAF AND STREAK.

In the control of the tomato virus diseases described above, the emphasis must be placed on prevention and a large measure of success can be achieved by strict attention to certain precautions. Firstly, the seed-bed should be established on new land or on sterilized soil and all weed growth should be removed from its vicinity for some time prior to and during the propagation of the seedlings, because some hosts of the tomato mosaic may be present among these weeds. Furthermore, the seed-bed should not be located close to flower gardens because many ornamental plants are known to be capable of harbouring viruses affecting tomatoes. Seed should be selected from healthy plants only, for it has been demonstrated that certain virus diseases of tomatoes can be carried on seed.

Frequent inspections of the crop in the field are desirable, particularly while the plants are young. Any abnormal plants observed during these inspections should be removed and burned in order to avoid having them act as a source from which the virus can be spread to other and, as yet, unaffected plants. If the number of infected plants is relatively high—say greater than 10 per cent.—this measure may prove of little benefit. The hands and pruning knives should be washed in soap and running water after touching diseased plants so as to minimise the possibility of transmitting disease to healthy plants. Smokers should also thoroughly wash their hands as above before handling a tomato crop, as tobacco may be a source of infection. The remains of the crop should be cleaned up and burned as soon as it has ceased to be profitable and volunteer tomato and potato plants, Solanaceous weeds and other host plants, which are likely to carry these diseases on until the following season, should be eradicated. The excessive use of nitrogenous manures should be avoided as these appear to render the tomato plant rather susceptible to some of the virus diseases.

BIG BUD.

Big bud disease is probably known to all regular tomato growers. It is difficult to describe the appearance of the infected plant in words, but Plate 11 illustrates the most common symptom and makes obvious the reason for the name "big bud." Another type of symptom seen is that known as "rosetting." In this case shoots normally produced in the leaf axil appear as a bunched mass of small narrow leaves. Prior to these rather obvious symptoms there is actually a cessation in growth of the stem, which is often followed by a blueing of the growing tip, and the flower hands instead of curving downwards tend to point upwards. The bizarre forms leading to the name "big bud" are malformed flowers in which the stalks have thickened considerably and the flower itself becomes grossly distorted by an enlargement of the floral parts, while the petals assume a green colour.

The disease is due to a virus, and while only one insect has been proved to spread the disease there may be others. The incriminated carrier is one of the leafhoppers or jassids. It is a small sucking insect approximately $\frac{1}{8}$-inch long, of a grey-brown colour with speckled wings. The presence of leafhoppers generally is readily discerned by disturbing the bushes, which causes them to dart out for a short distance and then either return or lodge in the next bush.

Plate 11.
BIG BUD.—Typical symptom of the disease.

Usually a grower sees only an occasional plant affected with this trouble but in some districts there is a definite possibility of an appreciable economic loss. There are two important points to be noted with regard to its entry into the crop and subsequent spread:—

(1) The disease almost always enters the tomato crop from other hosts outside the crop itself.

(2) It is spread by an insect and not by handling, which is in contrast to mosaic.

On hosts other than tomato the "big bud" symptom is usually absent and the symptom common to most is that of green flowers. A rosetting effect is also fairly common. Well known plants which have been proved to be hosts in this and other States of Australia are weeds such as dock, nightshade, and sow thistle; and garden plants such as antirrhinum, gerbera, petunia, nasturtium, chrysanthemum, dahlia, geranium and phlox.

Control.

In the light of the above information on the spread of the disease the simplest means of control is to reduce the outside sources of infection and control the leafhopper within the crop. Complete elimination of other hosts is not possible but it is suggested that particular attention be paid to eliminating weeds on the headlands. For control of the leafhopper within the crop either 0·1 per cent. DDT spray or 2 per cent. DDT dust may be used. While the insect is prevalent, treatments will need to be repeated approximately every 10 days. It is unlikely that treatment need commence before November in southern Queensland, but it is recommended that the grower take good note of the leafhopper population in the adjacent weed areas. If this is high and there are indications that the weed growth may die off due to dry conditions or other causes then dusting or spraying will need to commence earlier. The removal and destruction of diseased plants as soon as detected should also assist in reducing the spread, but it should be realised that the plant is actually infected at least three weeks before the appearance of the noticeable symptoms. In northern Queensland the disease is active to some extent throughout the winter months also.

SPOTTED (BRONZE) WILT.

Spotted wilt is sometimes known as bronze wilt because of the fact that the young shoots of an infected plant develop a dark reddish-brown or bronzed appearance. This is produced by a more or less close aggregation of circular purplish-brown spots each measuring approximately $\frac{1}{8}$-inch in diameter (Plate 12). Other symptoms include the stoppage of active growth, the bending back of the leaf stalk, and the incurving of the blades of the leaflets, thus giving a drooping appearance to the plant. Leaves which have developed the bronzed appearance wither and finally dry up. Bronze markings or a blotched yellow and green appearance of the skin may develop occasionally on the fruit of affected plants.

This virus disease, like "big bud," is spread by insects and not by handling the plants. The insects in this case are two species of thrips. Coinciding with the rapid increase in thrips population in early spring that period is usually the main one for the incidence of spotted wilt. It also tends to be more prevalent in backyard gardens than in commercial vegetable areas. This is due to the number of ornamentals that may carry this same virus—for example, Iceland poppy, nasturtium, and dahlia.

This disease cannot be called a major problem in the main tomato-growing areas of Queensland, as the infection is usually less than 1 per cent. There are, however, some areas, such as the dairying areas west of Brisbane, where tomatoes are frequently grown as a side line, which have recorded relatively high infection percentages of up to 40 per cent., and that for a large proportion of the season.

Control.

The measures outlined under mosaic control are sufficient for most districts. Where the disease appears regularly each spring, definite preventive measures will be necessary. A 5 per cent. nicotine dust is the treatment recommended. The 2 per cent. DDT dust as used for

corn ear worm control may incidentally give sufficient control of the thrips. Treatment will need to commence in the very early spring months and carry on into early summer.

Plate 12.
SPOTTED OR BRONZE WILT.—Note the close aggregation of spots, causing mottling.

BLOSSOM-END ROT.

This disease is characterised by the appearance of a light-brown to black, roughly circular area at the blossom end of young green fruit (Plate 13). The tissue of this discoloured region is firm and may be shrunken to form a slight depression or flattening of the apex. A soft rot may appear in it, but such a development is due to the invasion of secondary organisms. The early symptoms of the trouble take the form of small light-brown stains on the apex of the fruit.

This trouble is a physiological one and is not due to the attack of any plant parasite. It is considered that blossom-end rot incidence is associated with differences in the rate of water uptake and transpiration by the plant. When the temperature is high and the amount of water vapour in the atmosphere is very low, the quantity of water

transpired by the foliage of a plant may be so high that the uptake of water by the roots is unable to keep pace with the loss of water from the leaves. This disturbance of the water balance in the plant reacts severely on the fruit and the cells at the apex collapse, causing the typical firm lesion to develop. A dry soil, by limiting the uptake of water by the roots, is conducive to the development of the trouble, but, on the other hand, plants growing in a soil which has dried gradually do not develop blossom-end rot as seriously as those which have experienced a period of heavy rain prior to the hot, dry weather. Infestation of the roots by nematodes, which reduce the efficiency of the roots as water absorbers, aggravates the trouble.

Blossom-end rot is a disease of tomatoes which is usually prevalent during hot, dry periods in summer and spring.

Plate 13.
BLOSSOM-END ROT.

Control.

The control of this disease is, to some extent, beyond the power of the grower. However, he can help by providing an even supply of moisture throughout the growth of the crop by means of appropriate cultural practices and prudent irrigation. Heavy applications of fertilizers rich in nitrogen are undesirable, as these tend to produce abundant foliage, a condition which is conducive to the development of the trouble. When planting a crop it is well to remember that plants grown on the ground are less susceptible to the disease than are staked or trellised crops. If irrigation is not available the grower is strongly recommended to avoid staking or trellising his crop.

SHADE SPOT.

The most obvious symptom of this disease is apparent after the fruit has ripened, when areas of the fruit fail to colour. Beneath the skin in the affected area can be seen an indistinct brown discolouration due to the breakdown of vascular and surrounding tissue. The defect can also be detected on the mature green fruit, though the colour differentiation is only slight.

Observations up to the present indicate that the cause is physiological. The affected fruit are almost always from the first hand of unpruned tomato bushes and the factor most easily correlated with its occurrence is the reduced light occurring in the middle of the bushes, particularly in the winter and early spring. The seasonal effect may be due to the shorter days and aggravated possibly by lower temperatures.

This trouble does not cause heavy losses to the grower but is yet sufficiently serious to cause some concern.

Control.

The obvious means of control is to open out the centre of the unpruned bushes. On examining an average unpruned tomato bush it will be noticed that there are four to seven main stems on which the main crop is borne. Arising from these stems, particularly towards the centre of the bush, are a number of smaller shoots which tend to compact the centre of the bush, reducing the light intensity considerably. The majority of these smaller shoots would need to be removed and also some of the leaves.

CUTICLE BLOTCH.

The characteristic symptom here is the formation of an extensive dark lesion on the shoulder and side of the fruit which is most exposed. The lesion is only skin deep but after a few days the area tends to shrivel and flatten out and the skin becomes distinctly tough.

This disease is almost certainly physiological as it is invariably associated with periods of rain, particularly drizzly weather, occurring in the late winter and early spring. While a number of varieties are affected it is most commonly encountered on the trellised crops of Salads Special as this is the principal variety in fruit at this period of the year. The damage is usually associated with those areas of the cuticle which are covered with fine cracks and is possibly related to that occurring on citrus fruit in Queensland and known as "rind breakdown." It is usually apparent in winter-grown crops and can cause practically complete loss of all fruit that is approaching maturity during the crucial period.

Control.

There are no practicable means of control at present, though it is possible that certain varieties (for example, Salads Special) may be more susceptible than some others; these should be avoided where

PUFFY FRUIT.

Fruits affected by puffiness have an angular flat-sided appearance and are springy to the feel. They are also lighter in weight than the normal fruit. On cutting the fruit across it is noticed that the central fleshy areas that normally carry the seed and pulp are so reduced that there are definite air spaces betwen the outside wall of the fruit and the seed-bearing portion.

This trouble is not due to any particular fungus or bacterium but is apparently caused by certain unfavourable growing conditions. The damage is considered to be done at the time when pollination of the fruit is taking place. The efficiency of pollination may be reduced by extremes of temperatures and soil moisture and so result in a poor development of seeds and the tissues that are associated with the seeds.

It is probably most important in the early spring crops. Some varieties are definitely more susceptible than others. The best general guide to the varietal susceptibility is given by the number of cells, or locules, that occur in the fruit. The smaller the number, the greater the loss from puffiness.

Control.

There are no definite recommendations for control. Overseas workers consider that excess nitrogenous fertilizer will encourage the disease, while the ample use of superphosphate will reduce it. The grower is recommended to make use of this information but must realise that puffiness may still occur to some extent.

SUNSCALD.

Sunscald is characterised by the appearance of a white patch on the shoulder or side of the green fruit that is most exposed to the sun. This spot is quite firm and tough and does not rot unless some secondary organism becomes established in the diseased tissue.

In general it only occurs in the hotter months in Queensland and often follows the defoliation of the plants by one of the leaf diseases or tomato mite.

Control.

Some varieties (for example, Break o' Day) carry such a sparse foliage that even under good growing conditions and no abnormal defoliation the fruit will sunscald. In general it is recommended that heavy foliaged varieties such as Rutgers be used for the hottest periods of the year and that such disease control measures as prevent loss of foliage be carried out.

CATFACE.

Some fruits develop a very irregular and malformed growth at the flower end (Plate 14). While certain environmental conditions such as poor pollination in winter and early spring may accentuate this trouble, it is definitely bound up with the variety used. Its economic importance is not as great as formerly owing to improved seed selection.

Control.

The most important measure here is to use seed only from reliable sources. In general the varieties with deep globular fruit have less catface than the flatter types of fruit, but careful selection of seed materials is the obvious control method.

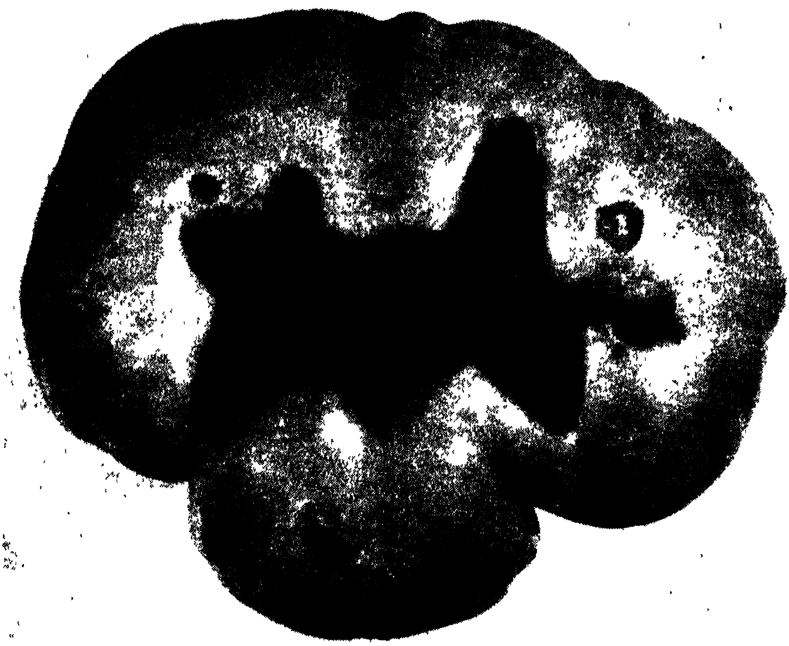


Plate 14.
CATFACE.

BLOSSOM-DROP.

The name given to this disorder adequately describes it. Actually blossom-drop is associated with a number of disorders and diseases but it has been separately mentioned here as it is sometimes the most obvious symptom.

First it must be realised that any backward stunted plant will often shed its flowers. Most growers are aware of this, but when vigorous healthy bushes do not set fruit the cause may not be obvious. The most likely reasons are as follows:—

(i.) If flower-drop occurs in July and August it is due to chilly nights preventing adequate pollination. English cluster varieties (for example, Salads Special and Potentate) and so-called Chinese varieties (such as Rouge de Marmande) are not as susceptible as the varieties Break o' Day, Rutgers, Earliana, &c., and should be used in this season.

(ii.) If flower-drop occurs in warmer parts of the year (autumn and late spring) the hand should be examined carefully for any lesions or spots. If small indefinite greasy lesions are present on the flower hand the cause is probably bacterial spot. If the lesions are possessed of rather definite edges, slightly shrunken and dull black in colour, the trouble is probably caused by the fungus responsible for target spot. Control in each case will be by the measures normally taken for the disease in question.

(iii.) Flower-drop may also occur on plants that have received an excess of nitrogenous fertilizers, particularly if the mixture has been unbalanced. This is more likely to occur in the warmer weather than the cooler months, because in the latter periods it is difficult to produce over-vigorous plants even when excess nitrogen is present.

[TO BE CONTINUED.]

The Young Farmer.

New Clubs.

May was a particularly busy month for the Junior Farmers' Club movement in Queensland, no fewer than six new clubs being formed in this period by the State Director (Mr. T. L. Williams). These were at Warwick (36 members), Allora (12), Wondai (12), Mondure (10), Cloyna (12), and Tiaro (15). The number of members at each centre is expected to show a considerable increase as Club work and activities become more widely known in the districts.

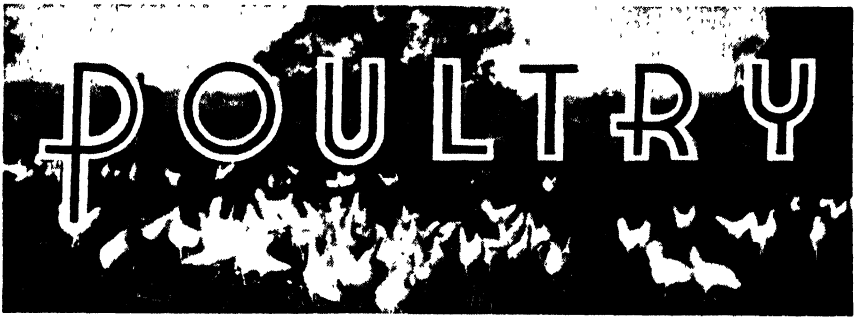
Murgon Show.

The State Director visited the three-day annual show of the Murgon Agricultural, Pastoral, and Horticultural Society and personally supervised the junior judging competitions sponsored by the Show Society and *Queensland Country Life* newspaper. These competitions were open for the first time to members of recognised junior farmers' clubs in the South Burnett area, as well as to farmers' sons residing within 30 miles of Murgon, with an age limit of 25 years. Two junior farmer members won the judging competitions for dairy stock (Jerseys) and pigs, the winners being E. W. Kerkow (Wondai) and R. O'Neill (Murgon), respectively. The A.I.S. judging competition was won by N. Shelton (Hivesville).

The Show Society also included in its schedule for the first time a farm produce section open to junior farm members only. This attracted several individual exhibits from both male and female members. A non-competitive exhibit from all districts where clubs have been operating for more than six months will be staged at the Royal National Show in Brisbane in August.

Central and Northern Tour.

Mr. Williams has in mind the formation of a number of clubs in central and northern districts and is making a tour for this purpose.



Poultry Nutrition: Principles and Practices.

P. RUMBALL, Officer in Charge, Poultry Branch, and F. N. J. MILNE,
Assistant Husbandry Officer (Poultry).

(Continued from page 363 of June issue.)

OTHER ATTRIBUTES OF A FOOD WHICH MUST BE CONSIDERED.

Palatability.

NO matter how well-balanced a ration is it must also be attractive to the birds if sufficient food is to be consumed for normal functions. For example, barley as the grain portion of the ration contains almost the right quantities of protein and carbohydrate essential for egg production, but it is found in practice that fowls do not relish the grain and have to become accustomed to it. It may be as well to mention here that any alteration in the ration for laying stock should be made gradually, as sudden changes often cause a reduction in consumption with a consequent fall in egg yield. If this change is made in autumn when young pullets are just coming into production it may result in a false moult.

In the fowl the senses of taste and smell are poorly developed and food is in the first place selected by sight. In addition the food is judged by the touch, the feeling as it passes down the oesophagus and the sensation it gives to the crop and gizzard. Memory also plays an important part, because, from past experience, the fowls avoid those foods which cause them discomfort. Initially sight is the determining factor. The bird prefers the shiny surface of some grains to the dull surface of other grains; light-coloured foods are favoured above darker ones, and there is a definite liking for green.

The texture of the mash is of great importance. In palatability tests at the Nebraska Agricultural Experiment Station 200 Leghorn layers consumed 270 pounds of a coarsely ground mash, 175 pounds of a medium ground mash, and 115 pounds of a finely ground mash. The birds had free and equal access and all mashes were exactly the same except for the size of the particles of the three ingredients—maize, lucerne meal, and bran. In compounding the coarse mash, the maize and lucerne meal were ground with $\frac{1}{8}$ of-an-inch hammer mill screen, and all three (maize, lucerne meal, and bran), in the fine mash passed through a 1/32-of-an-inch screen.

The average results of a test of finely ground all-mash feeding against coarsely ground all-mash with Leghorn pullets at the Ohio Agricultural Experiment Station for two years running were:—

Mash.	Eggs per Bird.	Food per Bird.	Consumption per Doz. Eggs.	Mortality.
		Lb.	Lb.	%
Coarse ..	139·5	66·05	5·70	19·3
Fine ..	120·5	61·92	6·19	24·5

The advantages generally attributed to fine and coarsely ground mashes are:—(1) Finely ground mash has a better appearance, there is less picking over and wastage; (2) coarse granular mash is more palatable, and results in better food consumption and increased egg production; it is less subject to deterioration, costs less for grinding and retards the loss of vitamin A.

Very finely ground all-mash should not be fed to chickens, as the powdery fineness of the mash may penetrate the nasal passages and cause clogging.

Digestibility.

The chemical composition of a food will only give a rough indication of its value, since not all of the crude protein, carbohydrates, fats, and minerals is digested. Digestibility trials have been carried out on most species of domestic animals with common foodstuffs to determine the percentage of the various ingredients utilised. This percentage is the "digestibility coefficient" and is calculated as follows:—

$$\text{Digestibility Coefficient} = \frac{\text{Wt. of ingredient eaten}-\text{Wt. of ingredient excreted.}}{\text{Wt. of ingredient eaten.}}$$

In tests carried out in 1937 by E. T. Halnan, the digestibility coefficients of the constituents of bran for poultry were determined, and are given here in comparison with the values for sheep:—

Animal.	Crude Protein.	Crude Fibre.	Fat.	Carbohydrate.
	%	%	%	%
Fowl ..	60·5	9·2	53·3	38·7
Sheep ..	77·2	54·4	80·7	74·1

It can be seen that fibre in bran is digested to a much smaller extent by poultry than by sheep.

METHODS OF FEEDING.

Several methods of feeding are commonly practised, and in many instances with an equal degree of success. Each method has its own advantages and appeal to the individual feeder.

In any case it should be pointed out with as much emphasis as possible that it is far more important to supply poultry with adequate quantities of all of the necessary nutrients than it is to follow a given system. However, any system that ignores the principles of sanitation and economics may fail, no matter how well the poultry may be nourished.

The methods of feeding practised are known as (1) wet mash and grain, (2) dry mash and grain, (3) all-mash, (4) free choice, and (5) pellet feeding.

Wet Mash and Grain.

Wet mash is a mixture of various ingredients, moistened to the extent that when a handful is squeezed it will remain in mash form and when dropped a few inches will break into small particles. It would be more correct if this class of mash were termed "moist" instead of "wet."

With this type of feeding the mash must be prepared daily for distribution to the birds, care being taken to provide sufficient without allowing any to remain unconsumed half an hour after feeding. The mash should be placed in shallow narrow tins or troughs, and as the food should be consumed within about half an hour there should be no lack of feeding space, otherwise the timid birds will not procure all they require for maximum production.

It is usual to feed wet mash first thing in the morning and grain late in the afternoon. Many breeders reverse this order with successful results and find that it fits in better with the daily routine.

Dry Mash and Grain.

In this type of feeding, a mash similar to that used for a wet mash, is prepared dry and placed in hoppers. Birds are at liberty to consume the food at will, and although certain feeding space has been found necessary for best results, the more timid fowl has a better chance of securing its requirements from a limited space than is the case in wet-mash feeding. The advantage of this system of feeding is that instead of mixing and feeding mash daily, a quantity can be prepared and distributed once a week, thus reducing the labour of feeding. A serious drawback, however, is that the constant supply of feed encourages rats to harbour in the poultry pens. With this system of feeding, grain is usually fed about 4 p.m.

All-Mash.

As the name suggests, nothing but mash is fed. A suitable mixture is made and placed in hoppers, to which the birds have access at all times throughout the day. With the all-mash system, quantities of food can be placed out once a week, thereby saving the daily attention of feeding. The birds are also compelled to consume a ration suitably balanced. Fowls do not take kindly to radical changes in grain-feeding, but with the all-mash system the meal of various grains may be substituted without any appreciable easing in production. Naturally, the conversion of grain into meals slightly increases the cost of feeding.

Free Choice or Cafeteria System.

Under this system of feeding, various kinds of foods are placed in hoppers or receptacles and the birds allowed to select their own requirements. The range of foodstuffs must be sufficiently wide to supply all

the food constituents essential to health and production. It has been noted that birds placed on this system of feeding after being fed by other methods have gorged on certain foods, but this gorging is only temporary. The birds soon adjust their feeding habits and consume only as much of the various foods as is necessary for health and production.

Pellet Feeding.

The pellet system of feeding is in effect a modification of the all-mash system in that an all-mash diet is first prepared and then made into pellets. The advantages claimed for it are that it does not permit the bird to pick out some of the ingredients and leave the others and that it tends to reduce the quantity of feed thrown from the hoppers and wasted. It does ensure that all the birds will eat the same kind of feed.

Feeding Systems Tested.

Experiments have indicated that the free choice system of feeding is very satisfactory, although there is little difference between it and the mash and grain system; and that the all-mash system of feeding is the most costly. Therefore, the all-mash system is not advocated for feeding laying stock, although with chickens under the age of eight weeks, where consumption is not great, it has given the most satisfactory results and proved economical.

The New South Wales Department of Agriculture has reported that in a comparison of wet-mash, dry-mash, and all-mash systems of feeding there was no difference as regards growth and economy of feeding up to the laying stage. Over 12 months laying there was no significant difference between the egg production from wet and dry mash, but the all-mash feeding was not as good as either of these systems. Experience in Queensland does not entirely support this work. In nutritional experiments conducted by this Department with chickens purchased as day-old from hatcheries and on dry all-mash feeding an average of 204 eggs has been obtained during the first year's lay and after culling during the second year 157 eggs.

Better production than the foregoing could not be expected under any feeding system. However, as all-mash feeding is the most costly, it cannot be recommended as a general practice.

FOOD REQUIREMENTS.

The first call made on the food digested is for maintenance of vital functions, such as the beating of the heart, breathing, repair of tissues, &c. Only after these requirements are met is digested food used for production. If fowls are not "full-fed" production suffers. "Full-fed" means as much of a balanced ration as the birds will eat. A hen in lay will consume approximately 4 oz. of food daily. This is a variable quantity and is influenced by the climatic and production conditions and breed characteristics. Heavy breeds consume more than light breeds.

TABLE 1.

PROTEIN AND FIBRE CONTENT OF SOME POULTRY FOODS.

Food.	Average Protein. Per cent.	Average Fibre. Per cent.
Group I.—Cereals.		
Maize and maize meal	9·5	3·0
Wheat and wheat meal	12·5	4·0
Barley and barley meal	10·6	5·0
Oats	10·0	11·0
Wheat bran	14·7	11·0
Pollard	14·5	7·4
Sorghum	10·0	7·0
Millet	11·6	8·0
Group II.—Animal Proteins.		
Meat and bone meal	45–55	..
Buttermilk, dried	35	..
Buttermilk protein	68	..
Skim milk, dried	37	..
Skim milk, fresh	3·8	..
Liver meal	62·5	..
Group III.—Vegetable Proteins.		
Linseed meal	28	12
Cottonseed meal	40	10
Cottonseed meal, standard	30	25
Peanut meal	48	6
Bean and pea meal	25	7
Coconut meal	18·5	12
Group IV.—Legumes.		
Lucerne leaf meal	22·0	15·0
Lucerne, before flowering	21·0	25·9
Lucerne, full flower	15·0	31·0
Lucerne chaff, good	20·7	20·0
Lucerne chaff, poor	16·6	25·2
Group V.—Supplements.		
Sterilized bone meal	13–20	..

FORMULATING RATIONS.

To prepare an all-mash ration, select at least three of the foods from Group I. in Table 1 (no more than two to be of wheat origin if only three are selected). This group comprises from 70 to 90 per cent. of the ration.

Select at least one food from Group II., this to make up from 5 to 10 per cent. of the ration unless skim milk is available. If skim milk is fed at the rate of 4 gallons per 100 birds daily, there will be no need to include any feeds from Group II. Also, if the milk is fed at this rate, the protein content of the ration can be reduced by 3 lb. per 100 lb.

If the feeds of Group II. are much more costly than those in Group III., include one food from Group III.

If no green feed is fed, include 5 lb. to 10 lb. per 100 lb. of either of the feeds in Group IV., depending on whether yellow maize is being fed. Whatever the ration, include ½ lb. of salt. For layers and growing stock, the full ration should contain approximately 15 lb. of protein and 8 lb. of fibre per 100 lb.

TABLE 2.

AVERAGE VITAMIN CONTENT OF SOME FEEDSTUFFS.

Kind.	Vitamin A. per lb. Inter Units.	Vitamin B1. per lb. Inter. Units.	Vitamin D. per lb. A.O.A.C. Units.	Vitamin E. ‡	Vitamin B_2 (Riboflavin) Microgram per lb.
Barley.. ..	400	250	Trace ..	XX	400
Maize (Yellow)	3,180	270	†	XX	450
Maize (White)	0	270	†	XX	450
Cowpeas ..	1,360	450	†	*	350
Milo	250	*	†	*	400
Oats	80	270	†	XX	400
Peanut Meal ..	250	900	†	XX	1,200
Wheat.. ..	140	340	†	XX	400
Wheat Bran ..	150	450	†	XX	1,000
Wheat Germ Meal ..	1,900	1,930	†	XXXX	1,800
Wheat Middlings near Pollard ..	120	1,000	†	XXX	900
Cottonseed Meal	600	1,800	†	*	300
Linseed Meal	200	2,000	†	X	900
Buttermilk, Dried ..	200	400	Trace ..	X	9,000
Cod Liver Oil..	340,190	0	45,360	0	0
Liver Meal ..	*	*	*	*	18,500
Meat Scrap ..	*	*	†	*	2,700
Skim Milk (Liquid) ..	15	40	†	X	1,000
Green Lucerne	63,560	225	†	XX	2,000
Lucerne Meal..	13,000	400	†	XXX	5,000
Lucerne Leafmeal ..	32,000	400	14	XXX	7,000
Cabbage ..	200	100	†	*	100
Molasses ..	*	*	†	*	2,000
Kale	181,400	100	†	*	2,240

* Information on vitamin content is lacking.

† Means that the feedstuff contains no appreciable quantity of Vit. D.

‡ X Fair source of Vitamin E.; XX Good Source; XXX Very good source; XXXX Excellent source.

Extracted from the United States Department of Agriculture Year Book, 1939.

Where mash and grain are fed, the ration may be made up as with the all-mash ration, but allowance must be made for the fact that half of the ration will be fed separately as grain. In this case, the mash will have to be higher in protein in order to balance the low protein content of the grain portion of the ration, but the total of the two should supply the same amount of protein per 100 lb. of food fed.

In feeding laying hens, the effect of the foods upon the colour of the yolk of eggs should also receive consideration. Commercially, yolk colour does not appear to have caused any concern, but the consuming public do not favour pale-yolked eggs. To overcome this, green feed and yellow maize should form a part of a laying ration. In the absence of green feed, lucerne chaff or meal should be used.

TABLE 3.

AVERAGE MINERAL CONTENT OF SOME FEEDSTUFFS.

Kind.	Calcium.	Phosphorus.	Manganese.
	Per cent.	Per cent.	Per Million Parts.
Barley	·05	·36	16
Maize (Yellow)	·01	·29	5
Maize (White)	..	..	..
Cowpeas	·10	·46	30
Milo	·04	·32	15
Oats	·10	·44	20
Peanut Meal	·18	·56	Information Lacking*
Wheat	·04	·39	39
Wheat Bran	·11	1·21	119
Wheat Germ Meal	·07	1·01	160
Wheat Middlings	·08	·93	119
Cottonseed Meal	·23	1·18	18
Linseed Meal	·33	·74	40
Buttermilk, Dried	1·56	1·05	·4
Cod Liver Oil	..	..	..
Liver Meal	·11	·90	4
Meat Scrap	8·25	4·00	18
Skim Milk Liquid	·13	·11	Trace
Green Lucerne	·42	·07	7
Lucerne Meal	1·44	·21	26
Lucerne Leaf Meal	1·90	·22	30
Cabbage	·07	·04	21
Molasses	·56	·06	Information Lacking*
Kale	·18	·07	ditto

* Information on the manganese content is lacking, but since only relatively small amounts are used in mash manufacture, the contribution from this source would not be of any great value.

Extracted from the United States Department of Agriculture Year Book, 1939.

TABLE 4.

RECOMMENDED NUTRIENT ALLOWANCES FOR POULTRY.*

—	Amount per lb. of Feed.	
	Starting Chicks.	Laying and Breeding Hens.
Total Protein (per cent.)	18–20 (*a*)	15–16
Vitamins—		
Vitamin A (International Units) (*b*)	2,000	3,300
Vitamin D (A.O.A.C. Units)	180	450
Thiamin (milligrams)	0·9	..
Riboflavin (micrograms)	1·6 (*c*)	1·3 (*c*)
Panthothenic Acid (milligrams)	5·0	7·0
Nicotinic Acid (milligrams)	6·0	..
Pyridoxin (milligrams)	1·6	1·6
Biotin (milligrams)	0·045	0·07
Choline (grams)	0·7	..
Minerals—		
Calcium (per cent.)	1·0	2·25 (*d*)
Phosphorus (per cent.)	0·6	0·75
Sodium Chloride (per cent.)	0·5	0·5
Manganese (parts per million)	..	50 (heavy breeds) 40 (light breeds)

(*a*) For growing chickens the protein content of the ration can be reduced to 16 per cent. by 12 weeks of age. Scratch grain feeding may be started at 6–8 weeks of age.

(*b*) May be either fish oil vitamin or provitamin A. from vegetable sources.

(*c*) The riboflavin content of rations for growing chickens after 8 weeks of age and of rations for laying hens is kept at the same level.

(*d*) This amount of calcium need not be incorporated in the mixed feed, since calcium supplements fed free choice are considered as part of the ration.

* The information is taken from "World's Poultry Science Journal." 1 lb. = 454 grams; 1 gram. = 1,000 milligrams = 1,000,000 micrograms; 1 microgram = 1/454,000,000 lb.

Example.—To make a mash to be fed in conjunction with grain as an evening feed to laying hens requiring 15 per cent. of crude protein in the total ration:—

Ingredient.	Quantity.	Protein.	Fibre.
	Lb.	Lb.	Lb.
As Grain—			
Sorghum	25	2·50	1·00
Maize	25	2·37	0·75
As Mash—			
Maize Meal	15	1·42	0·45
Sorghum Meal	12	1·20	0·48
Bran	10	1·47	1·10
Meatmeal (55% protein)	6	3·30	..
Cottonseed Meal	2	0·80	0·37
Lucerne Chaff	5	0·85	1·50
Total	100	13·91	5·65

This ration is slightly deficient in protein. As the maximum amount of cottonseed meal has been used and the ration is still deficient in protein, peanut meal (a protein-rich food which can be used to a greater degree than cottonseed meal) will serve the purpose, displacing cottonseed meal and 3 per cent. of maize meal. The corrected ration will then be as follows:—

Ingredient.	Quantity.	Protein.	Fibre.
	Lb.	Lb.	Lb.
As Grain—			
Sorghum	25	2·50	1·00
Maize	25	2·37	0·75
As Mash—			
Maize Meal	12	1·16	0·36
Sorghum Meal	12	1·20	0·48
Bran	10	1·47	1·10
Meatmeal (55% protein)	6	3·30	..
Peanut Meal	5	2·40	0·30
Lucerne Chaff	5	0·85	1·50
Total	100	15·25	5·49

Let us now examine the vitamin and mineral content of this ration, as calculated from Tables 2 and 3, with particular reference to its vitamin A, riboflavin and manganese contents:—

Ingredient.	Quantity. Lb.	Vitamin A. I.U.	Riboflavin Microgrammes.	Manganese Parts per Million.
As Grain—				
Sorghum	25	6,250	10,000	375
Maize	25	79,500	11,250	125
As Mash—				
Maize Meal	12	38,160	5,400	60
Sorghum Meal	12	3,000	4,800	180
Bran	10	1,500	10,000	1,190
Meat and Bone Meal ..	6	..	16,200	108
Peanut Meal	5	1,250	16,000	Not known
Lucerne Chaff	5	65,000	25,000	130
Total	100	194,660	88,650	2,168
Per lb.	..	1,946·6	886·5	21·6

Although this ration is now balanced as far as protein and fibre are concerned, it is definitely lacking in vitamin A, riboflavin and manganese. These levels are inadequate for layers, and the ration would give disastrous results as far as breeding stock are concerned.

Let us take each in turn:—

Vitamin A.—As shown in Table 4, the recommendation for layers and breeders is approximately 3,300 I.U. The vitamin A content of this ration can be built up in two ways:—(1) by the use of fresh green feed—at least 5 lb. per 100 birds daily; (2) by the use of a vitamin A supplement in the form of fish oil. If a fish oil of 1,000 I.U. potency per gram was used, at least ¾ per cent. would be added to an all-mash ration and twice this amount (1½ per cent.) to the mash-protein of a mash-grain ration. One per cent. equals about 1 pint (20 fluid ounces or 40 tablespoons) per 100 lb. With an oil of higher potency a lesser amount in proportion to the increased potency is necessary.

Riboflavin.—The estimated value is 450 micrograms short of the adequate allowance for layers and breeders. This shortage may be overcome in three ways:—

(1) By feeding green feed *ad lib.*; (2) By the use of liquid, dried or skim milk, buttermilk powders, dried whey, or liver meal. In this instance, using buttermilk powder it would be necessary to recast the ration and substitute an equivalent amount of buttermilk for peanut meal. If liver meal were used about half this quantity could be substituted for peanut meal.

(3) By including synthetic riboflavin in the mash. The amount used is very small and can be mixed with common salt, which, in this case, can be added as a supplement to the ration.

Manganese.—Because of the limited use of wheaten by-products (bran and pollard) this ration is inadequate as regards manganese. The manganese content could be lifted by recasting the whole ration and substituting bran for maize meal and part of the sorghum meal. Even then we would only succeed in approaching the minimum requirement of 40 p.p.m. for light breeds. Without recasting the ration, we can add a manganese supplement in the form of manganese sulphate to the mash at the rate of 4 oz. to the ton. This will ensure a supplemented level of 30 p.p.m., which, added to the amount already calculated, will give a value just over 50 p.p.m. The manganese sulphate could be incorporated in the salt and riboflavin mixture, which would now be as follows for mixing a ton of mash where salt mixture is used at the rate of 1 per cent.:—

Salt—20 lb.

Riboflavin supplement—as directed by the vendor.

Manganese sulphate—4 oz.

TABLE OF WEIGHTS AND MEASURES.

In order to prepare mashes with any degree of accuracy it is necessary for the various ingredients to be weighed. As scales are not

available on all farms the average weight of the various kinds of foodstuffs most commonly used is given for two convenient measures, the kerosene tin and the quart measure. These weights refer to the measures being filled but not pressed.

Kerosene Tin.

Bran	12 lb.	Maize (whole)	28 lb.
Pollard	18 lb.	Maize (cracked)	25 lb.
Lucerne meals	12 lb.	Wheat and Sorghum	30 lb.

Quart Measure.

	lb. oz.		lb. oz.
Barley meal	1 8	Linseed meal	1 0
Bone meal	1 12	Pollard	1 0
Bran	0 8	Salt (fine)	2 0
Maize (whole)	1 12	Wheat	1 12
Maize meal	1 8	Wheatmeal	1 8
Meatmeal	1 8		

Bushels to Short Ton.

Maize	35.7	Bran }	100
Barley	40	Pollard }	100
Sorghum	33.3	Oats	50
Wheat	33.3		

THE FEEDING OF CHICKENS.

In the feeding of chickens it is most important to bear in mind that nature has provided for the first day or so of the chicken's life, as just prior to hatching the balance of the egg yolk is drawn into the abdomen of the chick. Most breeders allow at least 48 hours to elapse before feeding. Chickens fed earlier are subject to bowel trouble. If, however, feed is withheld after the 48 hours, weakness develops, from which many chickens will not recover.

Requirements of Growth.

Chickens make very rapid growth in the early part of their life. This development is most rapid during the first six to eight weeks, consequently rations having a relatively high protein content are necessary to give the best development. From experimentation it has been established that rations having a crude protein content of 18 to 20 per cent. should be used during the first six to eight weeks, and after that period this should be reduced to 15 per cent. The protein requirement of a chicken does not alter as sharply as this, but these periods and protein content are suggested as meeting the practical requirements of the poultry-raiser.

The practice adopted by many poultrymen of reducing the protein content of a ration after the chickens are about 16 weeks of age in order to delay sexual development is desirable if the birds are maturing

too rapidly. Development, however, can be controlled to only a very limited degree, and the danger of under feeding protein must be avoided, particularly with pullets that have just commenced laying and have still to make further development. With these birds it is better to slightly lift the protein level—16 per cent. is recommended. On the other hand, excessive protein feeding must be guarded against, as the over-feeding of protein-rich foods causes deposits of urates in the ureter, kidneys, and other organs, and places an undue strain upon the liver.

Table 5, showing the food consumption of chickens, has been compiled as a result of experiments conducted in this State, the ration used approximating Mixture 1 in Table 6.

TABLE 5.

FOOD CONSUMPTION OF CHICKENS.

Age.	Leghorns.		Australorps.	
	Weight of Chickens.	Food Consumed Weekly.	Weight of Chickens.	Food Consumed Weekly.
	Oz.	Oz.	Oz.	Oz.
Day old	1·3	..	1·36	..
1 week	1·97	1·64	2·14	1·53
2 weeks	3·31	3·36	3·61	3·32
3 weeks	5·31	4·80	5·84	5·05
4 weeks	7·61	6·46	8·68	7·20
5 weeks	9·94	7·58	12·08	6·89
6 weeks	12·92	8·96	15·86	10·62
7 weeks	16·65	8·65	20·17	13·95
8 weeks	20·41	13·29	25·31	15·05

The variation in weight from week to week and the ever-increasing amount of food required suggest the undesirability of laying down hard and fast rules as to what quantity should be supplied. The food requirements increase week by week, and a system of feeding which enables the growing birds to consume all they require is the most desirable.

By reason of the fact that the kind of food consumed is easily controlled, and that it is always in front of the birds, the all-mash system of feeding chickens is suggested as being the most desirable. All-mash should be placed in shallow trays about 1 inch in depth during the first few days. Trays of a depth of 2 inches should then be used, and by the end of the first week narrow trays or troughs 4 inches deep should replace these. At this age chickens will commence to scratch with more vigour, scattering the feed from the trough. This can be prevented by placing a piece of netting on top of the mash loose enough to sink as consumption takes place. During the first week 8 lineal feet for feeding space should be allowed for every 100 chickens; this should be later increased to 12 feet. Prior to the mash being covered with netting it is important that only a little food at frequent intervals be placed in the trays in order to avoid wastage.

In fact, the frequent feeding of all-mash appears to induce greater food consumption and better development.

Breeders who do not desire to feed an all-mash may make use of commercial chick grains and starting-mashes which may be fed as directed by the manufacturers. It has been the custom for many poultry-raisers to use scratch grain only for a short period of a chicken's life, but in view of the more satisfactory results obtained by feeding a ration of a relatively higher protein content than is usually contained in chick mixtures, early mash feeding appears essential.

Chickens may be reared satisfactorily upon moistened mashes and grain from about two weeks of age, but the mashes must be fed at frequent intervals. This system offers the advantage of utilising milk, when available, for moistening the mash. The feeding of dry mash, however, is suggested as a safer method, as the possibility of food becoming sour and the probable consequent bowel trouble among chickens are avoided.

All-Mash Mixtures.

The mixtures shown in Tables 6 and 7 are suitable for feeding young stock.

TABLE 6.

MIXTURES FOR CHICKENS—DAY-OLD TO 6–8 WEEKS.

Ingredient.	Mixtures.			
	1.	2.	3.	4.
Yellow Maize Meal	38	..	..	20
Wheat Meal	..	43	43	20
Sorghum Meal	..	20	20	25
Bran	20	20	15	10
Pollard	20	..	..	..
Lucerne Meal	..	..	5	5
Protein Meal (55 per cent.)	9	9	14	12
Buttermilk Powder	10	..	..	5
Liver Meal	..	5	..	..
Ground Limestone or Shell	1	1	1	1
Synthetic Riboflavin	..	..	(As directed by vendor)	
Vitaminised Preparation	1	1	1	1
Manganese-Salt Mixture	1	1	1	1
	100	100	100	100

If a good succulent green feed is not available to be fed in conjunction with these mashes a vitamin A preparation should be used as a supplement.

Owing to the impossibility of obtaining a wide range of ingredients, mixtures have to be very simple. Where bran is not available a good sample of crushed whole oats would make a useful addition. Oats are a valuable food. They have been omitted as they are not usually available.

TABLE 7.

MIXTURES FOR GROWING BIRDS—8–20 WEEKS.

(Birds having access to direct sunlight.)

Ingredient.	Mixtures.			
	1.	2.	3.	4.
Maize Meal	35	..	..	..
Wheat Meal	30	40	51	66
Sorghum Meal	..	22	12	..
Bran	10	10	..	20
Pollard	20	10	20	..
Lucerne Chaff (Leafy)	4	4	6	4
Protein Meal	5	8	9	6
Ground Limestone or Shell	1	1	1	1
Manganese-Salt Mixture	1	1	1	1
Liver Meal	4	..	..	2
Milk Powder	..	4	..	2
Synthetic Riboflavin		(As directed by vendor.)		

RATIONS FOR LAYERS.

Suitable laying mashes for feeding with grain are given in Table 8.

TABLE 8.

LAYING MASHES TO BE FED IN CONJUNCTION WITH GRAIN.

Ingredient.	Mixtures.				
	1.	2.	3.	4.	5.
	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.
Wheat Meal	26	..	..	..	..
Maize Meal	..	18	10	..	..
Sorghum Meal	..	..	..	23	20
Crushed Oats	..	..	23	..	..
Bran	16	20	..	16	16
Pollard	33	31	40	34	36
Meat and Bone Meal	10	14	14	13	13
Buttermilk Powder	4	4	4	4	04
Linseed Meal	..	2	..	..	..
Lucerne Meal	10	10	8	9	10
Salt	1	1	1	1	1

Supplements :—

Vitamin A .. .. Unnecessary if choice lucerne meal is fed ; otherwise feed fish oils.

Calcium .. .. .. Shell grit *ad lib.* or ground limestone or oyster shell at 2 lb. per 100 lb. mash.

Synthetic Riboflavin .. If buttermilk powder and liver meal are short, use synthetic riboflavin for breeders. In all rations buttermilk could be replaced by meatmeal or linseed meal and synthetic riboflavin added.

[TO BE CONTINUED.]

MARKETING

The Development of the Wheat-growing Industry in Queensland.

C. H. DEFRIES, Assistant Director of Marketing.

(*Continued from page 370 of the June issue.*)

Distribution of Production.

PLATE 15 has been prepared to illustrate the distribution of production in the various local authority areas of the wheat belt and clearly demonstrates the dominance of the shires of Wambo, Pittsworth and Jordaryan. Details of production are given in Table 2.

TABLE 2.

AVERAGE ANNUAL AREA OF WHEAT PLANTED FOR GRAIN, PRODUCTION AND YIELD PER ACRE IN VARIOUS WHEAT DISTRICTS FOR THE PERIOD 1940–41 TO 1945–46.

Source—Queensland Government Statistician.

Local Authority Areas and Statistical Divisions.	Area Planted.		Production.		Yield per Acre.
	Acres.	Percentage of State Total.	Bushels.	Percentage of State Total.	Bushels.
Wambo Shire	80,029	24·1	1,661,984	26·8	20·77
Pittsworth Shire	48,937	14·7	982,619	15·9	20·08
Jondaryan Shire	45,309	13·6	859,334	13·9	18·97
Clifton Shire	31,151	9·4	562,673	9·1	18·06
Millmerran Shire	24,654	7·4	514,395	8·3	20·86
Glengallan Shire	21,156	6·4	359,048	5·8	16·97
Allora Shire	19,936	6·0	400,892	6·5	20·11
Rosalie Shire	14,908	4·5	258,488	4·2	17·34
Cambooya Shire	13,040	3·9	217,688	3·5	16·69
Remainder of Downs Division	10,477	3·1	141,083	2·3	13·47
Bendemere Shire	8,643	2·6	84,090	1·4	9·73
Bungil Shire	6,602	2·0	56,036	0·9	8·49
Remainder of Roma Division	694	0·2	2,764	..	3·98
Rockhampton Division ..	3,820	1·2	44,876	0·7	11·75
Maryborough Division ..	2,126	0·6	26,393	0·4	12·41
Moreton Division	1,096	0·3	16,409	0·3	14·97
Central-Western Division	24	..	168	..	6·94
Cairns Division	4	..	80	..	..
Total, Queensland ..	332,607	100·0	6,189,032	100·0	18·61

The growth of the industry and the development of new areas bring in their train many problems. The areas fortunately are well served by railway communications, but the need to establish new storage

sheds and intake facilities for handling the grain at the new centres and to extend those which expansion has made inadequate has presented the Queensland State Wheat Board with a particularly difficult problem, which, of course, is rendered all the more acute by reason of the post-war shortages of labour and materials for building.

The whole question of future methods of wheat handling in the face of present expansion is one that has to be given careful consideration. It has to be asked whether a bulk handling system should be substituted for the existing methods of bagged handling and storage, and no doubt the experience of other States of the Commonwealth and other wheat growing countries will have to be drawn upon to provide a basis for the solution of what is a most pressing and important problem.

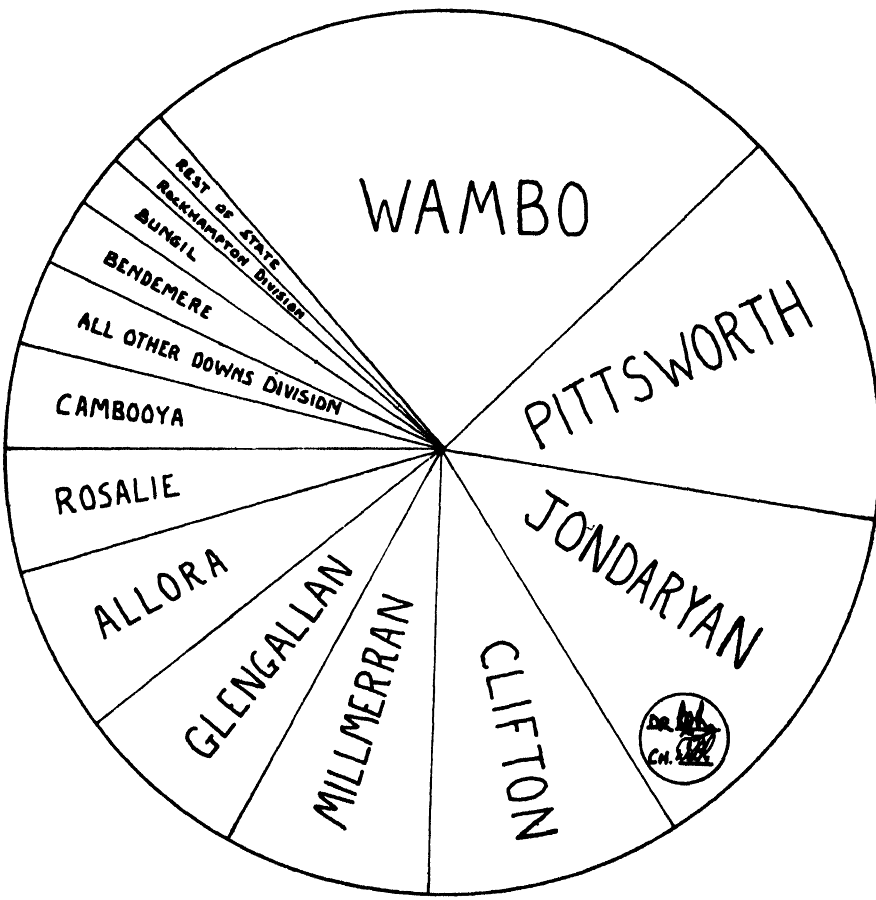


Plate 15.

WHEAT IN QUEENSLAND.—Chart showing the distribution of wheat production in local authority areas, based on the average area planted for the seasons 1940-41 to 1945-46.

Structure of the Wheat Industry.

Up to the present the Queensland wheat industry has been essentially one in which the small grower has predominated. During the period 1942-43 to 1945-46, an average of 82 per cent. of the growers in the State each grew under 200 acres. It has been indicated above that with mechanisation and the opening up of new country the larger wheat grower is more and more likely to become an important factor in the industry. Whilst this will give rise to problems which have not hitherto been encountered to any great extent in Queensland, nonetheless the smaller wheat farmers will remain an important group. They will continue to be influenced largely by the relationship between prices of wheat and of other products, but the value of wheat in the south-eastern Downs as a fodder crop will without doubt mean that the contribution from that area to the grain production of the State will continue.

Table 3 shows the number of growers of wheat and acreage planted in various farm size groups, averaged for the period 1942-43 to 1945-46 inclusive.

TABLE 3.

NUMBER OF GROWERS OF WHEAT IN VARIOUS FARM SIZE GROUPS.

AVERAGE FOR THE PERIOD 1942-43 TO 1945-46.

Acreage Group, Licensed Areas.	Growers.		Area Planted.	
	Number.	Percentage of State Total.	Acres.	Percentage of State Total.
1– 49	730	25·97	21,793	6·38
50– 99	842	29·95	57,797	16·92
100– 149	504	17·93	57,925	16·95
150– 199	238	8·47	38,543	11·28
200– 249	159	5·66	33,446	9·79
250– 299	92	3·27	23,969	7·01
300– 349	81	2·88	25,487	7·46
350– 399	39	1·39	13,748	4·02
400– 449	34	1·21	13,868	4·06
450– 499	25	0·89	11,398	3·34
500– 599	29	1·03	16,082	4·71
600– 699	17	0·60	10,314	3·02
700– 799	8	0·29	5,835	1·71
800– 899	4	0·14	3,110	0·91
900– 999	3	0·11	2,304	0·67
1,000–1,999	6	0·21	5,525	1·62
2,000 and Over	(a)	..	506	0·15
Total	2,812	100·00	341,651	100·00

(a) The average is less than half.

Although it seems certain that mixed farming will continue its important role in wheat areas, wheat will become more and more the predominant activity on some of the farms.

In the 1947-48 season, for instance, plantings were greater by 140,000 acres than the 4-year average in Table 3 and most of this additional area was planted by growers in the group of over 200 acres. As this trend continues the proportion of the crop grown by the group under 200 acres will correspondingly fall. In the period covered by the table the "under 200 acres" group was responsible for approximately 50 per cent. of the crop. In the 1947-48 season this group only provided approximately 40 per cent. of the crop.

This development is of particular significance, because under such circumstances the wheat grower will tend to become increasingly dependent upon the wheat crop for a stabilised income. The power, machinery, equipment and buildings needed to grow wheat on a larger scale will require substantial finance, and commitments arising from this capital expenditure will have to be met year by year.

The wheat grower will, to the extent that he is predominantly a wheat grower, be unable to achieve adequate stability by the internal adjustment of the enterprises of the farm—that is, by transferring from wheat to dairying or other enterprises—as has been the case in the past in Queensland. A small-scale mixed farmer, particularly when using horse-drawn implements, naturally had a widely fluctuating income from wheat. He could not effectively handle any large area and, if seasonal conditions were against him, he perforce had to feed whatever crop he had to dairy cows or sheep as green feed. Again, if the price differentials were against wheat growing, he might refrain from harvesting for grain even if the crop was promising, and utilise his wheat for green-feed. He could do this because the capital expenditure incurred for wheat growing for grain was not high in relation to total farm capitalisation. Such adjustments between using wheat for feed or for grain are not practicable *to the same extent* under conditions of mechanised wheat growing, although as mentioned later it may be possible to find alternative outlets for the grain itself. Income stabilisation will to a greater extent depend upon the overall condition of the industry and the correlation of market demand and production. Moreover, if wheat prices are depressed it can be expected that other grains will tend to be in a similar position. Much, of course, will depend upon the extent to which grain becomes an integral feature of production in the pastoral industry.

It is possible that much of the new country will undergo a transition from an essentially pastoral area to one in which wheat, and summer grains such as the grain sorghums, will be significant features of the rural enterprise. This does not mean that the pastoral industry will decline in these districts, but that it may be more and more associated with agriculture. In this event the grains may be diverted to this extent from the existing markets and be utilised locally as a means of effecting a more scientific production of lamb, mutton and beef, or pig and poultry products. If this takes place such a transition will be a net gain to the pastoral industry, particularly as it will help to expand the use of grains for feeding in districts where they may not be produced in sufficient quantity for local needs; thus, whilst the developments outlined will result in a large increase in wheat production for grain, not all of this will necessarily be an addition to the present market supply. Further, with the development of a grain sorghum industry with an established feed market arising from more scientific feeding of stock, there will be more opportunities for the transfer of resources from one grain to the other and this will affect not only market stability but also the development of desirable soil conservation methods.

Should such an association between wheat, grain sorghum and the pastoral industries develop, the whole area will benefit from the resultant enhanced stability.

The State Wheat Board.

The State Wheat Board, which was established by *The Wheat Pool Act of* 1920, has played an important role in the development of the industry.

The immediate occasion for the formation of the Board was the difficulty Queensland was experiencing in obtaining wheat from southern States at the close of the first world war except at the then high prices for export wheat, together with the further difficulty experienced by Queensland growers in taking advantage of the export prices. In 1916-17 Queensland grew 227,000 acres of wheat. This fell to 128,000 acres in 1917-18, and in 1918-19 to 22,000 acres.

During the war the Queensland Government had unsuccessfully attempted on two occasions to have Queensland brought within the scheme of controlled marketing which operated in other States. The main purpose of this scheme was to organise shipping for the export of wheat. Local wheat growers were therefore denied the 9s. 0d. per bushel price at ports which was then the basis of export prices and were forced to sell individually without the protection afforded by the organised pool operating in southern States. Early in 1920 the State Government guaranteed 8s. 0d. per bushel for all prime milling wheat from the 1920 harvest in an effort to encourage wheat growing. The immediate result of this was an increase in the area planted to 177,000 acres. The need to form a pool to permit collective bargaining was recognised and *The Wheat Pool Act* was passed to confer powers on a State Wheat Board with respect to the marketing of the wheat harvest of the season 1920-21. With modifications, the Act was later extended by Proclamation from year to year. Proclamations, the latest of which was issued on 27th May, 1944, now extend the term of the Act for periods of six years.

The Wheat Board was the forerunner of the many compulsory producer controlled marketing boards which have been set up in Queensland under the State's marketing legislation. At the time, the wheat legislation represented a drastic departure from the principles of voluntary co-operation inasmuch as the compulsory element in pooling primary produce was then introduced. It is noteworthy that this principle was later adopted not only in other States of the Commonwealth but also in other parts of the world.

Prior to the formation of the Board flour millers or their agents purchased wheat from individual farmers, either on inspection or by sample, on the basis of the price at Sydney less cost of transport to Queensland. Where farmers were unable, owing to lack of storage facilities or for financial reasons, to hold their crop, they had no alternative to selling at the price offered.

The Board was designed to provide a means whereby wheat growers could collectively handle and dispose of the Queensland wheat crop; in fact, act as a single bargaining unit in the market, as contrasted with each buyer dealing separately with individual growers.

The whole of the marketing functions between the farmer and the flour miller were taken over. These included assembling, grading, storing, insuring, arranging for transport, and disposing of wheat on the grower's behalf. During the period of acquisition of wheat under National Security legislation the Board acted as the sole licensed receiver for Queensland on behalf of the Australian Wheat Board.

In addition to the strictly marketing functions of the Board various services are performed on behalf of growers and to these brief reference might now be made.

Hail Insurance.

The Wheat Board administers a co-operative Hail Insurance Scheme which is based on the payment of premiums by the wheat grower from the moneys due to him from the sale of wheat by the Board. The rate of premium levy varies, but usually approximates ½d. per bushel. The scheme covers growers against loss incurred as a result of damage to their crops by hailstorms, which may occur on any part of the Darling Downs, principally during the months of October and November when the crop is nearing maturity.

The scheme was initiated in 1927 when Hail Insurance Scheme Regulations were issued under *The Wheat Pool Acts*. These regulations give the Wheat Board the necessary authority to establish a Hail Insurance Fund created by the payment of a compulsory levy assessed on the basis of the quantity of wheat delivered to the pool.

This permits what would otherwise be a serious loss to individuals to be spread over the whole industry, and its value is to be seen in the position in the 1945-46 season, as shown in Table 4. This gives some indication of the operations of the fund and illustrates the benefits and protection it has afforded to wheat growers.

TABLE 4.

HAIL INSURANCE SCHEME—SUMMARY OF OPERATIONS 1939–40 TO 1946–47.

Season.	Total Amount Levied.	Levy per Bushel.	Amount Paid on Claims.	Assessment Fees and Expenses, &c.	Balance in Fund at End of Season.
	£	*d.*	£	£	£
1939–40	13,225	½	10,099	221	20,225
1940–41	11,008	½	1,538	35	29,659
1941–42	5,499	½	938	22	34,199
1942–43	9,172	½	10,663	105	32,603
1943–44	9,637	½	13,426	215	28,599
1944–45	12,589	½	340	15	40,834
1945–46	48,511	1½*	56,449	298	32,598
1946–47	1,010	½	227	..	33,381

* This rate applied to deliveries and wheat on which compensation was paid, the levy on excess wheat retained on farms being at the rate of 1d. per bushel.

NOTE.—All amounts have been given to the nearest £1.

Finance.

The Board prior to Commonwealth wartime controls obtained finance through the Rural Credits Department of the Commonwealth Bank against a bill of sale over wheat delivered and insured. This permitted a first advance of 80 per cent. of the estimated value to be given. The advantage of this to the grower was that it enabled him to receive a substantial payment prior to the actual sale of the grain, and eliminated the obnoxious practice that obtained in pre-pooling days of forcing a sale because of the grower's financial embarrassment.

Necessitous Growers' Seed Wheat Scheme.

Each year the State Government guarantees funds, usually not exceeding £5,000, and indemnifies the Queensland State Wheat Board against loss through failure to recover payments to that amount on account of seed wheat which the Board may supply to growers in necessitous circumstances. Applications for assistance under this scheme are made by statutory declaration to the Board, each application being considered by the Board on its merits. The money is recovered from the first advance payments made on the wheat delivered to the Board.

Seed Selection.

For many years past the Wheat Board has co-operated with the Department of Agriculture and Stock in encouraging the cultivation of certain types of wheat which have satisfactory field characteristics combined with good milling quality. At one time there were over 70 varieties in general cultivation; as a result of these efforts the number has been reduced to 41, and only 15 of these were planted in sufficient quantity in the 1947-48 season to exceed 1 per cent. of the total acreage. The general arrangement is that the Wheat Board only distributes seed which has been approved by the Department.

The classification and premium payment scheme conducted by the Board is dealt with below.

Wheat Classification and Varieties.

The controversy regarding the desirability and practicability of modifying the f.a.q. system of wheat selling under which wheat is marketed in all States other than Queensland has in recent years focussed attention on wheat grading and classification. The subject has achieved particular prominence since the visit to Australia in 1946 of Dr. Kent Jones, an eminent British cereal chemist, who was invited by the New South Wales Bread Manufacturers' Association to visit Australia to advise on the setting up of a bread research institute. Later a Commonwealth-States Committee was set up, following a decision of the Australian Agricultural Council, to examine the pros and cons of instituting a Commonwealth-wide system of wheat classification.

Queensland is the only State in the Commonwealth which has a comprehensive and organised classification and premium payment scheme for wheat. This is conducted by the Queensland State Wheat Board. It is largely based on a visual classification together with a grading for bushel weights, and provides four classes, namely Q1, Q2, Q2A and Feed. Q1 wheat attracts a premium of 3d. per bushel and Q2 1½d. per bushel.

It will be noted that on the average 77.79 per cent. of wheat is classed as Q1.

The system of classification followed in this State has been admirably suited to local conditions in the past, as almost all of the wheat was for home consumption. It also was well adapted to climatic conditions which at times causes pinching of the smaller grains such as Pusa, which are strong milling wheats but which on an f.a.q. basis might tend to weigh on the low side. Light-weight wheats of this nature which have not lost milling quality by reason of dry weather, but only weight, can be placed in the premium classes.

Table 5 sets out the proportion of wheat in each of these classes for the years 1939-40 to 1947-48:—

TABLE 5.

CLASSIFICATION OF WHEAT DELIVERED TO THE STATE WHEAT BOARD, 1939–40 TO 1947–48.

Proportion of Each Class.

Season.	Milling Wheat.			Feed Wheat.
	Q1.	Q2.	Q2A.	
	Per cent.	Per cent.	Per cent.	Per cent.
1939–40	77·88	17·88	3·60	0·64
1940–41	87·49	9·04	3·17	0·30
1941–42	80·21	13·95	5·50	0·34
1942–43	62·14	24·84	10·59	2·43
1943–44	61·27	28·20	8·59	1·94
1944–45	93·50	3·80	2·70	0·00
1945–46	81·89	11·46	6·06	0·59
1946–47	86·83	8·59	3·16	1·42
1947–48*	68·91	12·85	8·89	9·35
Average	77·79	14·51	5·81	1·89

* Subject to revision.

Queensland has natural environmental advantages for the production of high quality wheats which generally not only have a higher gulten content but also a superior quality gluten to those of other parts of the Commonwealth. This has been substantially reinforced by the breeding of varieties suited to local conditions. In the 1947-48 season wheat bred in this State constituted 75 per cent. of the crop.

Many claims have been made regarding deterioration in Queensland wheats but the record shows clearly that the proportion of varieties with medium to strong milling qualities has been increased. There have been, however, some changes in the composition of the group, and these are illustrated by Table 6. This sets out the area and proportion grown of the major varieties in two groups. The first includes those varieties considered as being medium to strong milling wheats; in the second group are those which normally are considered weak milling wheats, although the term "weak" is used only in a comparative sense in some cases.

The dominant position of the variety Puora, which constituted over one-quarter of the crop in the 1947-48 season, is of particular interest. Very favourable reports on this variety, which was bred by R. E. Soutter, as a desirable milling type have been given. The increase in the proportion of Puno is also marked. The two varieties Charter and Gabo, which are recent introductions from New South Wales, have also come into prominence of late years.

The decline in the area of Puglu from 17 per cent. of the crop in 1945-46 to 9 per cent. in 1947-48 is of importance, as much concern was previously felt regarding the popularity of this wheat, which was never officially released by the Department but which was found to yield particularly well under some conditions although its milling quality is not of a high order.

TABLE 6.

AREA AND PERCENTAGE OF VARIETIES GROWN IN QUEENSLAND, 1939–40, 1945–46, 1947–48.

Variety.	1939–40.		1945–46.		1947–48.	
	Area.	Proportion.	Area.	Proportion.	Area.	Proportion.
	Acres.	Per cent.	Acres.	Per cent.	Acres.	Per cent.
Pusa 4	21,058	5·84	6,986	1·75	6,003	1·24
Flora	45,137	12·52	22,221	5·57	10,345	2·14
Puora	29,584	8·21	89,027	22·32	128,501	26·54
Florence	19,603	5·44	3,801	0·95	1,103	0·23
Seafoam	35,018	9·71	29,874	7·49	33,612	6·94
Three Seas	31,839	8·83	22,061	5·53	22,208	4·59
Ford	21,806	6·05	16,637	4·17	17,343	3·58
Warput	20,608	5·72	22,507	5·64	16,095	3·32
Puseas	9,260	2·57	28,046	7·03	49,561	10·24
Puno	..	..	19,129	4·80	51,759	10·69
Charter	..	..	..	..	10,183	2·10
Gabo	..	..	..	..	8,517	1·76
Total	233,913	64·89	260,289	65·25	355,230	73·37
Eureka	..	..	28,051	7·03	8,361	1·73
Puglu	22,886	6·35	66,078	16·56	45,477	9·39
Novo	19,603	5·44	6,619	1·66	4,772	0·99
Seaspray	14,759	4·09	2,299	0·58	534	0·11
Currawa	13,338	3·70	7,684	1·93	2,940	0·61
Cedric	9,400	2·61	807	0·20	665	0·14
Gluyas	8,774	2·43	1,111	0·28	780	0·16
Fedweb	..	..	6,391	1·60	20,754	4·29
Others	37,786	10·49	19,606	4·91	44,601	9·21
Total	126,546	35·11	138,646	34·75	128,884	26·63
Total Queensland	360,459	100·00	398,935	100·00	484,114	100·00

The superior quality of Queensland wheats may well be a vital influence in the development of the industry in the future, and the need to take all necessary steps to ensure the maintenance of high quality is obvious.

It is now widely recognised that the milling quality of wheat is the result of a complex of influences which include not only variety, but environmental factors such as climate and soil fertility. However, even though in general terms environmental influences in Queensland give it better than average quality, some particular varieties have stood out as being particularly desirable milling wheats.

The above considerations emphasise that it would be undesirable for Queensland wheat to lose its identity in any uniform classification scheme on a Commonwealth-wide basis, although it might be that the existing classification and premium scheme in this State will need some revision if the maximum benefit is to be gained from the natural advantages that obtain, particularly in view of the possibility of permanent export surpluses.

The problem is one of exploring the position of the overseas market in relation to the special types of wheat available, and of providing a means whereby the grower himself is encouraged to concentrate production on the better varieties under favourable conditions.

Wheat Stabilisation and Prices.

Wheat is the most important agricultural crop in Australia and as one of the major sources of overseas funds the economic condition of the industry has always played an important part in determining the well-being of the Commonwealth. Queensland did not in the past, except for one year prior to the war, produce sufficient wheat for local consumption needs, and consequently the industry was not faced in so acute a form with the problems which confronted southern wheat areas as a result of violent fluctuations in export prices. Nonetheless, the industry here could not but be influenced to a significant degree by the economic condition of the industry generally. With the present expansion and the existence of substantial export surpluses there will naturally be an even closer link between external conditions and the industry in this State.

Plate 16 illustrates the extent of the post-war fluctuations in prices.

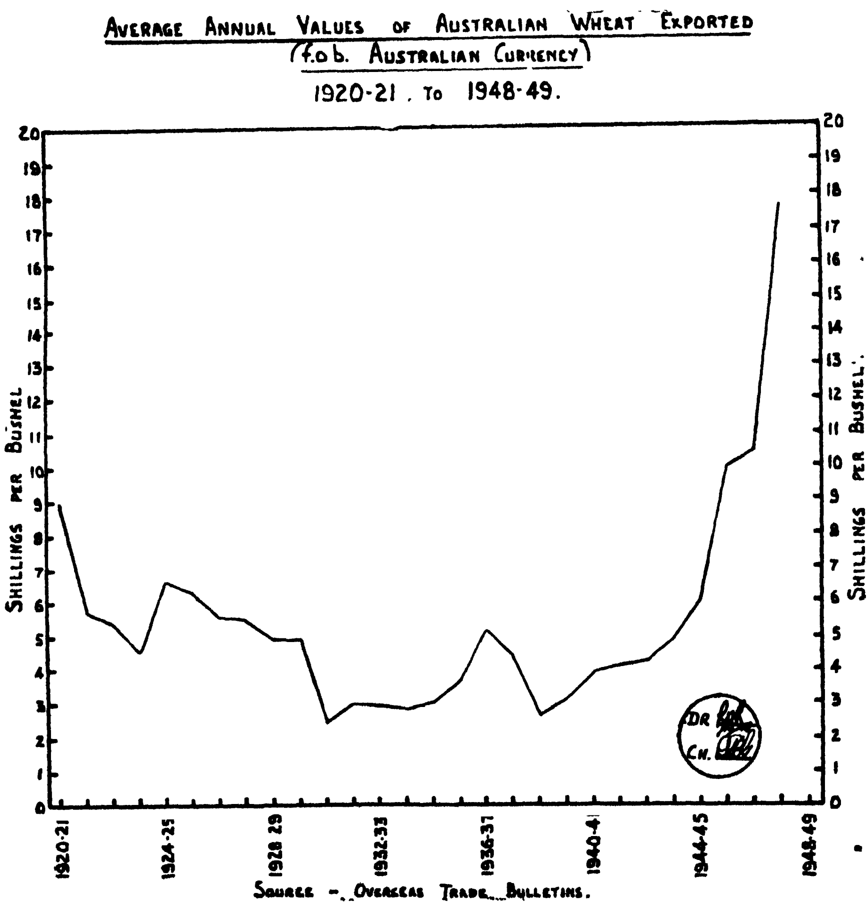


Plate 16.

WHEAT PRICES.—Graph showing average annual values (f.o.b., Australian currency) of Australian wheat exported, 1920-21 to 1948-49. (Source—Overseas Trade Bulletins.)

The general picture of instability that the wheat industry presented between the two wars was due to a complex of economic and other influences, but perhaps the most important were as follows:—

(*a*) The very high prices which prevailed subsequent to World War I led to attempts by European countries to increase production in rehabilitated areas.

(*b*) Optimistic settlement schemes in the Dominions, giving as they did an outlet for soldier settlement and migration, were proceeded with somewhat hastily and quickly provided increased production.

(*c*) Later the development of economic nationalism and the efforts associated therewith to diminish dependence on imported foods contributed to the uncertainties of the wheat market.

Many wheat growers found that the liabilities incurred during the boom periods of the post-war years were too heavy to be borne in the absence of Government assistance and stabilised markets and prices and, with the onset of the 1930-33 depression, wheat stabilisation became a vital issue in the rural economics of Australia. Up till this time the only efforts of any consequence that had been made to stabilise the industry were the Commonwealth pools organised during the first world war, when under the *War Precautions Act* wheat from the 1914-15 harvest was compulsorily acquired. This measure continued in force up to the 1920-21 harvest. However, this compulsory pool, to which Queensland was not a party, was primarily designed to organise shipping space for the export of wheat.

Following the first world war, voluntary co-operative pools operated in New South Wales, Victoria, South Australia and Western Australia, but, except in Western Australia, these handled a very small percentage of the crop. Even in Western Australia the percentage of total wheat production received by these pools declined from 96 in the 1921-22 season to 28 in the 1938-39 season.

Under the conditions of price fluctuation referred to above, the individual farmer had very little chance to achieve stability from his own unaided efforts. The Queensland wheat industry did not depend upon overseas markets for the disposal of the grain, but was certainly dependent on the condition of the overseas market as regards the price to be received. Consequently, the possibility of maintaining, or even of increasing, returns by reason of superior bargaining power, and economy in handling when organised under statutory authority, was a powerful incentive to the organisation of the State Wheat Board, as mentioned previously.

Table 7 shows the net returns to Queensland growers at country sidings for Q1 quality wheat from the inception of the pool.

In evaluating the net returns shown in the above table it is also necessary to take into account additional services rendered to growers by the Board, such as the administration of the Hail Insurance Scheme, the financing and insurance of the crop, seed selection, and the administration of the Necessitous Growers' Seed Wheat Scheme.

The introduction of the compulsory system of pooling permitted a measure of stability to be achieved that could not otherwise have been accomplished. Without the State Board the industry would have been particularly vulnerable to external conditions. However, whilst it was

possible to cushion the effects of price fluctuations and mitigate their influence within the State, economic conditions within the industry as a whole could not be completely by-passed. Consequently the efforts that were made over the years to establish a scheme of stabilisation for the industry in Australia were of substantial importance to Queensland. With export surpluses becoming available and with growers entering into heavy capital commitments to permit larger areas to be grown under mechanised conditions, the general trends in the world's markets must exert a powerful influence on local conditions that an isolated State Board could do little to remedy.

TABLE 7.

NETT RETURNS TO GROWERS FOR Q1 MILLING WHEAT AT GROWERS' SIDING, 1920–21 TO 1947–48.

Season.	Payments by State Wheat Board.	Payments by Australian Wheat Board.	Payments by Commonwealth and State Governments.	Total Payments.
	Per Bushel.	Per Bushel.	Per Bushel.	Per Bushel.
	s. d.	*s. d.*	*s. d.*	*s. d.*
1920–21	8 0	..	(*a*) 0 1·579	8 0
1921–22	5 0	..	..	5 0
1922–23	5 7·5	..	..	5 7·5
1923–24	5 3·5	..	..	5 3·5
1924–25	5 10·5	..	..	5 10·5
1925–26	6 3·5	..	..	6 3·5
1926–27	6 0	..	..	6 0
1927–28	4 11	..	..	4 11
1928–29	4 7·5	..	..	4 7·5
1929–30	4 0·3125	..	..	4 0·3125
1930–31	3 11	..	..	3 11
1931–32	3 6	..	(*b*) 0 4·5	3 10·5
1932–33	3 1	..	(*c*) 0 3	3 4
1933–34	2 10·625	..	..	2 10·625
1934–35	3 1·5	..	(*b*) 0 3	3 4·5
1935–36	3 11	..	..	3 11
1936–37	5 5·5	..	..	5 5·5
1937–38	4 0·125	..	..	4 0·125
1938–39	1 11·6875	..	(*d*) 0 4·549	2 4·2365
1939–40	(*e*) 0 2·5	3 2·958	..	3 5·458
1940–41	(*e*) 0 4	3 7·375	..	3 11·375
1941–42	(*e*) 0 3·25	3 7·625	..	3 10·875
1942–43	(*e*) 0 3·75	4 3·7	..	4 7·45
1943–44	(*e*) 0 3·75	5 1·833	..	5 5·583
1944–45	(*e*) 0 3·5	4 8·403	..	4 11·903
1945–46	(*e*) 0 3	7 2·875	..	7 5·875
1946–47	(*e*) 0 3	(*h*) 9 1·5	..	9 4·5
1947–48	(*g*)	(*g*) 12 1	..	12 1

NOTES.

(*a*) Amount made available to State Wheat Board by Queensland Government to meet guarantee of 8s. per bushel. The amount was distributed by State Wheat Board and hence is also included in that column.

(*b*) Commonwealth bounty.

(*c*) Relief payment by Commonwealth Government on wheat delivered. Additional payments were made on an acreage basis.

(*d*) Payment by Commonwealth Government on wheat delivered. Paid out of proceeds of Flour Tax.

(*e*) In these years, the crops were marketed by Australian Wheat Board, and State Wheat Board payments represent only Quality Premiums less Hail Insurance Levy of ·5d. per bushel.

(*f*) A levy of 1d. per bushel for Hail Insurance was deducted by Australian Wheat Board from payments to Queensland growers, and paid to State Wheat Board in this year. This figure includes a refund of Wheat Tax of 1s. 1·589d., plus interest.

(*g*) This pool is not yet complete and Quality Premiums have not been declared. Australian Wheat Board advances are not yet final.

(*h*) This figure includes a refund of Wheat Tax of 10s. 5d., plus interest.

Ever since 1914, efforts have been made by Governments and organisations within the industry to find an acceptable solution to the problem of stabilisation. Since the depression of the 1930's efforts have been even more intense. The disastrous collapse in prices in the early 1930's, when endeavours were being made to grow more wheat to increase exports to maintain the volume of credits in London, made wheat stabilisation one of the major economic problems confronting Australian primary industry. Until up to the outbreak of war many different plans were discussed, and some were embodied in legislation—for example the *Flour Tax Acts* and *The Wheat Stabilisation Act of* 1938. However, the operation of the last-mentioned Act was interrupted by the war, and it was not until 1948 that a peace-time Wheat Industry Stabilisation Scheme was finally given effect by the passing by all State and Commonwealth Governments of appropriate legislation.

At the outbreak of war in 1939 the Australian wheat industry was faced with considerable difficulty. Both Australia and Canada had large surpluses of wheat. Naturally it was the desire of the United Kingdom to buy wheat requirements as near as possible to her own shores in order to conserve shipping space and to diminish the danger of loss from enemy attack. As a consequence, wheat growers in Australia found themselves in a much less favourable position in regard to the disposal of their produce than did other sections of primary producers, such as those supplying wool, meat and dairy products.

As a result of the interruption to normal channels of sale and the dislocation of shipping facilities, and, further, because wheat was a staple food product the control of which was considered necessary for adequate defence, the Commonwealth Government used its war-time powers under the *National Security Act*, in September, 1939, to give effect to comprehensive control over both the production of wheat and the marketing of the crop. The scheme provided for compulsory acquisition by which the crop was required to be delivered to an Australian Wheat Board set up under National Security (Wheat Acquisition) Regulations, and for the registration of wheat farms and licensing of acreages under the control of a Wheat Industry Stabilization Board set up under National Security (Wheat Industry Stabilization) Regulations.

Queensland was the only State in the Commonwealth with a marketing organisation under statutory authority, and after considerable negotiation arrangements were made for the State Wheat Board to act as the sole licensed receiver in Queensland on behalf of the Australian Wheat Board. The State Board continued to conduct the hail insurance and classification and premium schemes on behalf of growers with the assent of the Commonwealth Board.

This system of marketing continued until December, 1948, when the war-time scheme was replaced by the wheat stabilization plan, hammered out after exhaustive negotiation between State Governments, wheat growers' organisations, and the Commonwealth Government, and given effect to by the passing of the Commonwealth Wheat Stabilization Bill of 1948 and complementary legislation in all wheat growing States.

This stabilization scheme, which commences with the 1948-49 crop and extends to include the 1952-53 crop, provides for a guaranteed price of 6s. 3d. per bushel f.o.r. ports bulk basis, for an export quantity of up to 100 million bushels. The guaranteed price will vary according to an index of production costs. The State legislation makes provision for a home consumption price equal to the guaranteed price. A stabilization fund is to be established by means of a tax on wheat exported amounting to 50 per cent. of the difference between the guaranteed price and the export price, but not exceeding 2s. 2d. per bushel.

In one very important respect this plan departs from what was generally accepted as an inevitable concomitant of such a scheme, namely production control. The legislation does not make any provision for the control of production, although States have agreed to ensure that wheat growing on marginal areas will be regulated.

As far as Queensland is concerned, the plan also departs radically from the type of organisation set up under National Security control in that the State's wheat marketing legislation has been retained intact and is fitted in as an integral part of the Commonwealth-wide scheme. The desirability of this approach is shown by the need to ensure that the Queensland Board is enabled legally to continue the Hail Insurance and Wheat Classification Schemes which have been of such value to Queensland growers. The legislation provides that effect is given to the plan by the State Wheat Board delivering wheat to the Australian Wheat Board on behalf of Queensland growers. The wheat will in the first place be delivered to the State Wheat Board under *The Wheat Pool Act* and be paid for by the State Wheat Board in accordance with this Act. The State Wheat Board will deliver the wheat to the Australian Wheat Board, and be paid for the wheat by the Australian Wheat Board under the new legislation.

One feature of the wheat situation which has tended to obscure the issue in regard to the need for stabilization has been the course of prices since the middle of the war. The rapid deterioration in the world food position from 1943 onwards resulted in phenomenal increases in prices of some food commodities. Wheat, particularly, changed from an over-supplied commodity to one in heavy demand with particular suddenness. Stocks in Australia declined from 152 million bushels on 30th November, 1943, to 11½ million bushels on 30th November, 1945. This was, of course, partly due to drought and crop failures in Europe in 1945, but it does reflect the increase in demand that occurred. The increase of export prices by 1947 up to an equivalent of over £1 per bushel at Australian ports did not provide an easy background against which to stress the need for stabilization. Since early in 1948 the course of prices has been downward, and there is every indication that this trend will continue. The graph in Plate 17, which is drawn from the "Economist" of 30th October, 1948, illustrates what has happened in the United States.

Conclusion.

It is clear from the foregoing that the most significant feature of the development of the wheat industry in Queensland is the possibility of regular participation in the export market of future years. Just how far this development will go is of course not easy to assess. The potential for further heavy increases in area is, however, obvious in view of the extent of first class agricultural lands available, although machinery

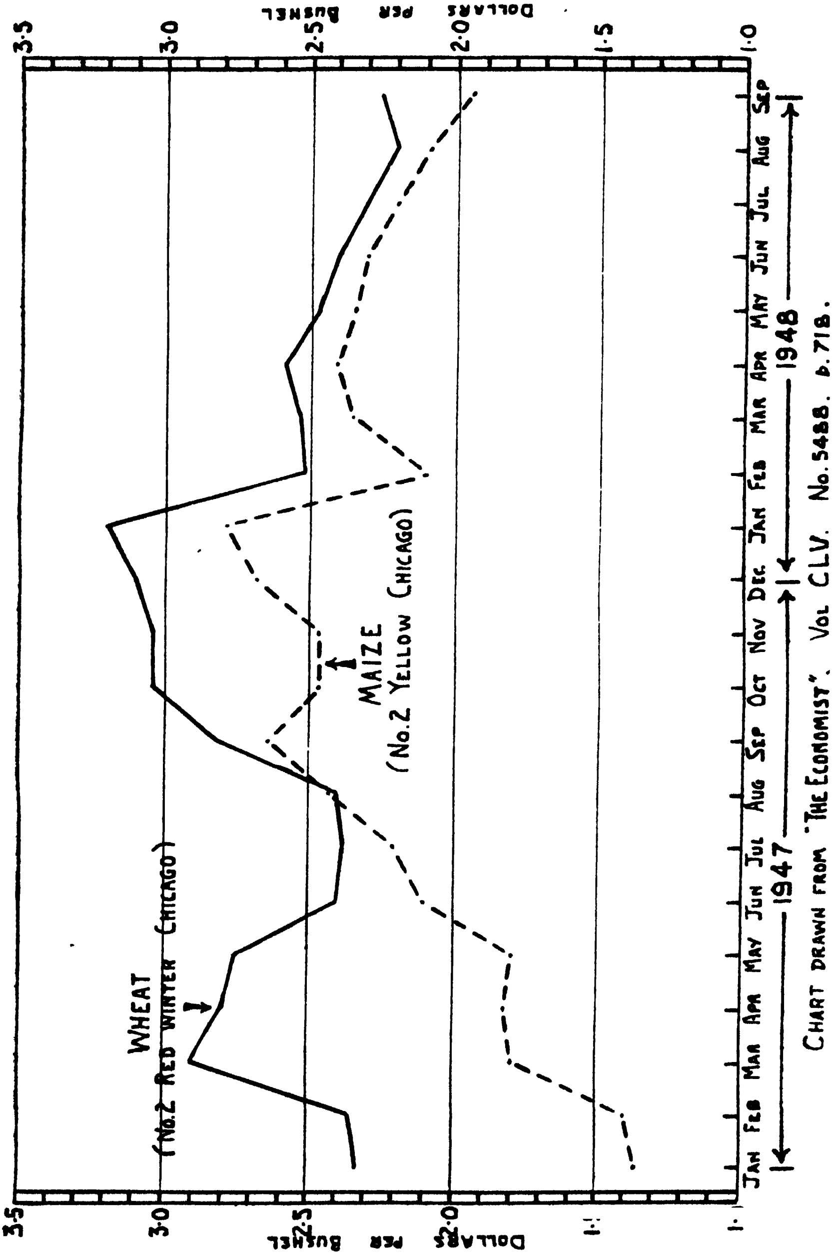


Plate 17.

WHEAT AND MAIZE PRICES, U.S.A.—Graph (redrawn from "The Economist"), showing Chicago prices for wheat and maize in 1947 and 1948.

shortages are still something of a brake on production. Of course, the economic factors which will determine the relative profitability of alternatives in resource usage are difficult to assess on a long-term basis, but it appears to be a definite possibility that an average production of well over 20 million bushels will be achieved in the near future.

The export surplus will of course be dependent also on local consumption. During the war there was a very rapid increase in the usage of wheat in Queensland, particularly subsequent to the commencement of the war with Japan. The demand for flour then necessitated the operation of the flour mills at their full three-shift capacity and the Commonwealth Government policy of subsidising feed wheat, with a view to stimulating the production of pigmeats, eggs, and dairy products, led to a substantial increase in demand for these purposes. Total sales of wheat in Queensland increased from 6,025,608 bushels in 1941-42 to 10,643,236 bushels in 1943-44. By the end of 1944 wheat was being consumed at the rate of 13 million bushels per year. Even with the institution of feed wheat rationing early in 1945 consumption in this State was at the rate of almost 10 million bushels in 1944-45. However, by 1945-46 it had fallen to approximately 8¼ million bushels, and by 1946-47 to 7 million bushels. Normal consumption would, it is thought, be something greater than in 1946-47, however, as during this period wheat for stock feed was particularly short owing to difficulties of transport from southern States.

Table 8 shows the trend in consumption for various purposes.

TABLE 8.

WHEAT CONSUMPTION IN QUEENSLAND, 1939–40 TO 1946–47.

Year.	Milling.	Feed Trade.	Seed.	Sundries.	Total.
(b)	Bushels.	Bushels.	Bushels.	Bushels.	Bushels.
1939–40 ..	3,843,955	952,550	49,407	(a)	4,845,912
1940–41 ..	4,439,568	969,352	76,185	(a)	5,485,105
1941–42 ..	4,776,533	1,170,165	78,910	(a)	6,025,608
1942–43 ..	5,992,571	1,857,376	81,155	(a)	7,931,102
1943–44 ..	6,794,058	3,722,900	126,278	(a)	10,643,236
1944–45 ..	5,671,124	3,874,011	208,387	61,633	9,815,155
1945–46 ..	5,272,634	2,745,278	127,874	66,412	8,212,198
1946–47 ..	4,749,676	1,870,192	178,968	130,541	6,929,377

(a) For these years sundries are included in feed trade.
(b) The year covered is from 1st December to 30th November.

Within Queensland itself it can be expected that wheat consumption will tend to increase, firstly because of increase in population, and secondly because of increased use of feed grains for livestock. In this, of course, wheat will have to compete with summer grown grains such as sorghum and maize. The development of more intensive methods of feeding dairy cattle and sheep, and of fattening beef cattle, is, of course, particularly important in this regard. Price relationships between the various grains and between grains and dairy, meat and poultry produce will, of course, be the determining factor. There can be no doubt that existing prices of feed grains retard their use for stock and poultry feeding.

So far as consumption generally is concerned it should be noted that, apart from the abnormal conditions of the war and post-war years and the consequent shortage of wheat and of other feeding stuffs, the tendency has been for the per capita consumption of wheat for bread in industrial countries to remain stationary or to decline. Studies made in this subject indicate that the most serious food shortages, apart from those which have arisen as a result of the war, have been in the protective

foods, which include items such as butter, milk, eggs and fresh fruit. It has been shown that, as purchasing power increases, the consumptive level of these types of foods tends to increase also. Wheat, which is an energy providing food, and which on lower economic levels is used as a substitute for the protective foods, does not show a similar consumption rise with increased incomes.

It has yet to be learnt whether this trend will be altered by reason of the increased use that can be made of the supplementary nutritional factors (such as vitamins and synthetic proteins) that can be added to bread. However, it is clear that, apart from the expansion of the market for stock feed, there is some doubt as to whether wheat consumption will expand in the present industrialised countries when the existing lag in supply is overtaken. Possibly, with increasing industrialisation and better living standards, the East will absorb a greater volume of wheat, but this is more likely to be a long-term development.

These considerations, together with price and production trends overseas, point to the possibility of a change from a sellers' to a buyers' market, and more intense competition amongst sellers. This may eventuate even if there is no collapse of the market such as occurred subsequent to the first world war and during the 1930's.

For the immediate future, therefore, it would seem that the industry in this State should take the opportunity to build up a reputation for high quality wheats that will be a bulwark against the effects of competition, and to this end every effort should be made to maintain the quality of Queensland wheat by means of proper selection of varieties and the efficient operation of farms with a view to maintaining the soil fertility upon which wheat quality is so dependent, and by ensuring adequate encouragement to growers of the high quality wheats.

Production Trends.

Suitable weather conditions in the first week of June permitted the start of the delayed general planting of wheat on the Darling Downs, and it appears certain that last year's record area of over 600,000 acres will be exceeded. It is estimated that 4,000 acres will be sown, partly for grain and partly for forage, in the Burnett.

The latest survey of the Queensland maize crop suggests that production will be at least three million bushels. Production on the Atherton Tableland is expected to be about 16,000 tons.

The estimate of grain sorghum production in the State is 1½ million bushels, exclusive of production on the Queensland-British Food Corporation project.

Harvesting of the autumn potato crop, which occupied about 5,500 acres, began in May, with an estimated yield of 11,500 tons. The May intake of the Potato Marketing Board was just over 53,000 bags, and 13,000 bags were imported from other States.

Several northern mills have commenced the 1949 crushing season, which promises to produce a larger crop of cane than the record of 1948, when 6,434,552 tons were crushed to yield 909,563 tons of sugar.

Butter and cheese production were lower in May than in the corresponding month of 1948, but prospects for winter production are fair.

PRODUCTION RECORDING.

List of cows and heifers officially tested by Officers of the Department of Agriculture and Stock, which qualified for entry into the advanced register of the A.I.S., Jersey, Guernsey, Ayrshire, and Friesian Societies' Herd Books, production records for which have been compiled during the months of January, February and March, 1949 (273 days unless otherwise stated).

Animal.	Owner.	Milk Production.	Butter Fat.	Sire.	Month Compiled.
		Lb.	Lb.		
AUSTRALIAN ILLAWARRA SHORTHORN					
MATURE COW (STANDARD 350 LB.).					
Silver Glen Fairy Star	V. R. Nugent, Murgon	10,454·95	421·614	Aynsley Victory	January
Pilton View Trixie	F. Derrick, Moonford	10,339 5	436·544	Sunnyview Myrtle's Renown	February
Tarradale Bluebell	F. Derrick, Moonford	9,698·75	420·16	Spot of Sunnymeade	February
Fernhome Doris	R. S. Griffiths, Moregatta	9,073·75	416·388	Glengarry Gem's Royal	February
Sunnycrest Daphne 3rd	A. H. Sokoll, Wondai	11,712 25	412·505	Oakvilla Excelsior	February
Tarradale Bracelet	F. Derrick, Moonford	9,919·75	410·651	Spot of Sunnymeade	February
Fernhome Marion	R. S. Griffiths, Moregatta	8,749·6	401·725	Glengarry Gem's Royal	February
Fernhome Vicky	R. S. Griffiths, Moregatta	7,394 25	397·105	Glengarry Gem's Royal	February
Chelmer Honeysuckle 3rd	A C. Marquardt, Mondure	9,856·75	392·619	Chelmer Champion's Renown	February
Fernhome Modesty	R. S. Griffiths, Moregatta	7,374·9	392·528	Glengarry Gem's Royal	February
Fernhome Josie	R. S. Griffiths, Moregatta	7,641·85	367 936	Glengarry Gem's Royal	February
Faversham Doris 2nd	H. V. Littleton, Crow's Nest	11,370·08	460 292	Chelmer Redman	March
Bantry Nellie	D. Sullivan, Pittsworth	10,341·3	459·558	Penrhos Blomsson's Prince	March
Applegarth Miss Emma 4th	F. Derrick, Moonford	11,052·75	454 542	Happy Valley Masterpiece	March
Rhodesview Queenie 27th	W. Gierke and Sons, Helidon	10,947·7	448 971	Fairvale Major	March
Rhodesview Butterfly 4th	W. Gierke and Sons, Helidon	11,674·15	445 45	Alfa Vale Nigel	March
Gentle of East Haldon	J. G. Lindenmayer and Sons, Mt. Sylvia	9,870·35	415 84	Epigram of Greyleigh	March
Calrossie Model 6th	W. D. Davis, Wambo	8,316·7	378 996	Fairvale Monarch	March
Glenore Shamrock 2nd	P. J. Donaghy and Son, Malanda	8,921 55	373·981	Sunnyview Melba's Hero	March
Applegarth Calm 8th	R. A. and N. K. Shelton, Hivesville	10,455·7	368 578	Applegarth Paramount	March
Fernhome Elaine	R. S. Griffiths, Moregatta	8,727·8	365·355	Glengarry Gem's Royal	March
SENIOR, 4 YEARS (STANDARD 330 LB.).					
Yarranvale Picture	W. Henschell, Yarranlea	12,491 14	541·627	Sunnyview Royal National	January
Fairholm Ivy 44th	R. A. and N. K. Shelton, Hivesville	10,689 9	373·164	Dulcamah Sundown	January
Ardilea Bud	H. W. Hinrichsen, Clifton	10,504 4	471 657	Newstead Reliance	March
Springleigh Pearl 11th	G. R. Moller, Monto	11,759·5	457·222	Blacklands Melba's Pride	March
Tesse of East Haldon	J. Lindenmayer and Sons, Mt. Sylvia	9,553·95	389·489	Epigram of Greyleigh	March
JUNIOR, 4 YEARS (STANDARD 310 LB.).					
Glenroy Ida	W. F. Kajewski, Glencoe	9,005·0	411·661	Blacklands Shiek	January
Fairvale Dulcie 5th (173 days)	W. Henschell, Yarranlea	7,536·1	325·57	Fairvale Reward	January
Balater Opal Queen	T. W. Fowler, Pittsworth	7,544·0	319·083	Ennismore Reliance	February
Applegarth Roan Calm 2nd	R. A. and N. K. Shelton, Hivesville	9,277·6	338 823	Applegarth Paramount	March
Faversham Bud 11th	H. V. Littleton, Crow's Nest	8,578·95	328·601	Croydon Marchese	March

		SENIOR 3 YEARS (STANDARD 290 LB.)			
Ripley Park Rosebud 3rd	I. B. Skerman, Kaimkillenbun	9,093·25	366·787	Newstead Jester	January
Vermont Hazel 36th	A. Lohse, Biggenden	8,959·4	311·319	Vermont Gamelin	January
Bingleigh Gentle 3rd	J. A. Lane, Kilcoy	8,217·05	310·219	Blacklands Jean's Victory	January
Alva Glen Orange	D. Birch, Memerambi	8,362·85	306·648	Springlands Favourite Prince	January
Alva Glen Biscuit	D. Birch, Memerambi	7,952·0	298·879	Alva Glen Lovely's Reward	January
Lynfield Heather Bell 3rd	F. E. Birt, Sexton	9,270·45	341·462	Parkview Ransom	February
Blacklands Miss Flirt 22nd	A. Pickels, Proston	9,168·2	310·041	Blackland's Carnation's Prince	February
Glen Idol Daphne 18th	Estate of P. Doherty, Gympie	11,722·7	423·626	Blacklands Count	March
Pilton View Jill	F. Derrick, Monto	9,306·25	349·67	Sunnyview Royal Day	March
Ripley Park Handsome 3rd	I. B. Skerman, Kaimkillenbun	7,834·01	346·502	Glenroy Security	March
Glen Idol Daphne 19th	Estate of P. Doherty, Gympie	8,997·65	331·119	Blacklands Count	March
		JUNIOR, 3 YEARS (STANDARD 270 LB.).			
Alva Glen Fairy	D. Birch, Memerambi	9,394·0	333·852	Alva Glen Lovely's Reward	January
Merridale Dolly	Giles Bros., Woowoonga	8,165·7	296·313	Springlands Pigeon's Eros	January
Fairvale Minerva 5th (191 days)	W. Henschell, Yarranlea	6,414·3	293·461	Fairvale Reward	January
Alfa Vale Model 29th	W. H. Thompson, Nanango	14,516·1	690·774	Alfa Vale Paisley	February
Blacklands Maiden 16th	A. Pickels, Proston	8,880·7	319·673	Blacklands Carnation's Prince	February
Jamberoo Winnie 9th	R. Herzig, Clifton	7,984·9	300·673	Murray Bridge Florrie's Prince	March
		SENIOR, 2 YEARS (STANDARD 250 LB.).			
Glen Idol Florrie 15th	Estate of P. Doherty, Gympie	8,196·4	328·484	Glen Idol Coronet	January
Ripley Park Rosebud 4th	I. B. Skerman, Kaimkillenbun	6,457·92	290·749	Glenroy Security	January
Glenroy Ettie	W. F. Kajewski, Glencoe	7,228·35	288·078	Fairholm Lewis	January
Glen Idol Daphne 26th	Estate of P. Doherty, Gympie	7,332·15	267·189	Blacklands True Blue	January
Glen Idol Daphne 25th	Estate of P. Doherty, Gympie	10,170·2	402·979	Glen Idol Regent	February
Euroa Design	P. R. Emery, Dallarnil	7,251·85	278·054	Euroa Tippler	February
Bunya View Orphan	Mrs. A. E. Powell, Chinchilla	6,071·55	260·054	Trevor Hill Reflection	February
Navillus Countess 7th	A. F. Ezzy, Mt. Emlyn	6,488·1	256·235	Parkview Limerick	February
Yarranvale Empress 2nd	W. Henschell, Yarranlea	9,319·24	354·924	Sunnyview Royal National	March
Balcarres Choice 5th	H. V. Littleton, Crow's Nest	7,731·39	295·141	Valera Daphne's Prince 2nd	March
Fairlie Cherry 21st	Messrs. Mitchell and Mulcahy, Warwick	6,833·45	291·904	Corunna Potentate	March
Roshill Betty 7th	W. Flesser, Boyland	7,375·85	266·703	Dnalwon Felix	March
		JUNIOR, 2 YEARS (STANDARD 230 LB.)			
Applegarth Miss Merle 5th	R. A. and N. K. Shelton, Hivesville	9,691·85	417·275	Fairholm Evidence	January
Trevor Hill Model	Madge Bros., Southbrook	8,930·2	386·479	Fairvale Jellicoe	January
Sunnyview Evelyn 16th	J. Phillips and Sons, Wondai	8,810·1	359·861	Alfa Vale Lex	January
Trevor Hill Golden	K. A. Ruhle, Motley	6,092·65	297·195	Fairvale Jellicoe	January
St. Andrews Gem 10th	M. C. Lester, Glengallan	6,604·65	292·068	Tabbagong Victory	January
Trevor Hill Pamela	Madge Bros., Southbrook	6,716·57	282·235	Fairvale Jellicoe	January
Ennismore Bud 3rd	E. W. Jackson, Nobby	5,754·6	249·762	Ardilea Ossie	January
Sunnyview Little Princess 9th	J. Phillips and Sons, Wondai	12,385·55	558·015	Sunnyview Kitchener	February
Penrhos Merle 15th	A. Sandilands, Warwick	7,560·25	323·777	Rosenthal McArthur	February
Penrhos Elva 20th	A. Sandilands, Warwick	7,639·6	296·861	Rosenthal McArthur	February
Sunnycrest Daphne 5th	A. H. Sokoll, Wondai	7,434·6	271·167	Blacklands Review	February
Wamba Model	W. D. Davis, Chinchilla	6,111·1	249·43	Navillus Narcissus	February
Wenlock Queen	H. G. Watson, Killarney	6,299·3	244·147	Alfa Vale Repeater	February
Trevor Hill Rosetta	Madge Bros., Southbrook	7,900·1	348·108	Fairvale Jellicoe	March
Applegarth Calm 13th	R. A. and N. K. Shelton, Hivesville	8,440·65	317·365	Fairholm Evidence	March
Trevor Hill Fairy	Madge Bros., Southbrook	7,320·75	308·457	Fairvale Jellicoe	March
Dorravista Vision 12th	H. A. Turner, Tarazali	6,962·9	307·655	Learmont Byron	March
Calrossie Lilac 4th	D. Lithgow, Jandowae	6,997·05	280·749	Avnsley Eclipse 3rd	March
Derradale Butterfly	F. Derrick, Moonford	7,001·0	266·993	Sunnyview Royal Ruler	March
Hillfield Tessie	S. J. Lester, Mulgowie	5,408·85	248·763	Blacklands Florrie 9th's Heir	March
Sunnycrest Coral	A. H. Sokoll, Wondai	6,381·05	241·53	Blacklands Review	March

PRODUCTION RECORDING—*continued.*

Animal.	Owner.	Milk Production.	Butter Fat.	Sire.	Month Compiled.
		Lb.	Ib.		
JERSEY.					
MATURE COW (STANDARD 350 LB.).					
Kathleigh Dairymaid	R. J. Crawford and Sons, Kingaroy	6,482·15	368·611	Calton Larris	January
Woodbine Boronia	W. S. Conochie, Sherwood	9,081·75	473·668	Trinity Cute Ruler	February
Glenrandle Handsome Lady	P. Kerlin, Killarney	7,673 6	443·126	Bellgarth Stylish	February
Palen Candytuft	His Majesty's Prison Farm, Palen Creek	7,219·7	382·665	Trinity Ginger Chief	February
Lermont Bud	J. Schull and Son, Oakey	7,102·4	375·957	Selsey's Samares Hallmark	February
Brookland Golden Drop	W. S. Conochie, Sherwood	6,846·85	364·559	Oxford Golden Peer	February
Bellgarth Showgirl 6th	C. W. and E. M. Barlow, Boodua	6,668·55	363·723	Oxford Fawn's Victor	February
Golden Hill Golden April	J. J. Bugler, Wowan	9,484·4	507·248	Trinity Golden Chance	March
Wyreene Rene	C. W. Barlow, Boodua	6,060·95	381·348	Navua Boutilliere's Lad	March
Westbrook Starbright 5th	V. Dunstan, Kin Kin	8,171·25	379·73	Selsey Royal Standard	March
Glenview Sultane's Jubilee	W. S. Conochie, Sherwood	7,477·5	372·149	Trinity Governor's Hope	March
Oxford Lola 3rd	E. Burton and Sons, Wanora	8,198·4	367·111	Oxford Maid's Victor	March
SENIOR, 4 YEARS (STANDARD 330 LB.).					
Trecarne Golden Dairy Girl 4th	I. L. M. Borchert, Kingaroy	7,947·6	381·594	Trecarne Ruler 2nd	January
Nairfale Noble's Rosemary (365 days)	R. J. Browne, Yangan	11,308·8	535·655	Nairfale Pride's Noble	February
Wyreene Daisy Bell	C. W. and E. M. Barlow, Boodua	9,563·25	487·883	Wyreene Marcella's Boy	February
Glenbrook Rose Nella 2nd	J. F. Lovell, Samford	8,603·7	407·639	Lermont Golden Victory	February
JUNIOR, 4 YEARS (STANDARD 310 LB.).					
Manneum Cosmos	R. D. Johnson, Kingaroy	8,505·1	476·002	Nimbrae Promoter	February
Glenrandle Tiny	P. Kerlin, Killarney	6,461·5	352·041	Bellgarth Glory King 2nd	March
SENIOR, 3 YEARS (STANDARD 290 LB.).					
Egmont Fussy May	I. L. M. Borchert, Kingaroy	6,127·8	348·299	Glenmaie Wonderful	January
Manneum Maidie	R. D. Johnson, Kingaroy	6,859·3	369 37	Nimbrae Promoter	February
Lermont Model 2nd	J. S. McCarthy, Greenmount	5,373·05	337·47	Trinity Noble Effort	February
JUNIOR, 3 YEARS (STANDARD 270 LB.).					
Kathleigh Carol	F. W. Kath, Moffatt, *via* Dalby	8,047·25	438 77	Oxford Fawn's Noble	January
Brooklodge Victorine	J. Ahern, Conondale	6,727 65	350·08	Trecarne Some Victor 4th	February
Romsey Annabelle	J. Wilton, Killarney	6,051·4	292·928	Oxford Pixie's Victor	February
SENIOR, 2 YEARS (STANDARD 250 LB.).					
Glenmoore Lady's Maid	I. L. M. Borchert, Kingaroy	5,736·25	277 959	Woodside Bindle's Design	January
Kathleigh Soya 2nd	C. W. and E. M. Barlow, Boodua	5,435·55	331 929	Oxford Fawn's Noble	February
Trecarne Attractive Lady	G. V. Tilley, Beaudesert	5,438·55	279·824	Trecarne Some Duke	February
Sunny Brae Princess 2nd	M. E. McCracken, Avondale	5,540·65	259·621	Echo Hills Eminent Royal	February
Boree Effort's Dahlia	W. and C. E. Tudor, Gayndah	8,627·16	377·208	Trinity Daffodil's Effort	March
Locherbie Glorious	C. Beckingham, Everton Park	5,940·2	323·97	Oxford Tarzan	March
Upwell Mrs. Seymour	E. W. Goody, Bancroft	5,622·5	267 267	Glenview Some Sultan	March
Lermont Cowslip 3rd	J. Schull, Oakey	5,054·15	295·101	Trinity Noble Effort	March
JUNIOR, 2 YEARS (STANDARD 230 LB.).					
Brooklands Regal Angela	W. S. Conochie, Sherwood	7,481·6	409·744	Brooklands Regalia	January
Glenrae Lady Skipton	V. Granger, Nerang	5,439·4	270·757	Oxford Skipton	January
Bellgarth Lucky Girl 2nd	D. R. Hutton, Cunningham	4,639·65	258·402	Walthorn Farm Brown Boy	January
Silverbrook Bertha	J. Schull, Oakey	4,161·2	235·36	Trinity Noble Effort	January
Broad View Effort's Barleycorn	W. S. Kirby, Byrnestown	5,139·7	284·976	Trinity Irondele's Effort	January

PRODUCTION RECORDING—*continued*.

Animal.	Owner.	Milk Production.	Butter Fat.	Sire.	Month Compiled.
		Lb.	Lb.		
	JERSEY—*continued*.				
Brooklands Regal Angela (305 days)	W. S. Conochie, Sherwood	8,051·2	441·453	Brooklands Regalia	February
Glen Erin Madeira	J. S. McCarthy, Greenmount	5,738·65	319 916	Ashfield Prometheus	February
Lermont Rosella 2nd	J. Schull and Son, Oakey	5,750·15	306·186	Trinity Graceful Duke	February
Lermont Gold Dust	J. Schull and Son, Oakey	5,430·1	291 718	Trinity Graceful Duke	February
Broadview Royal Fern	W. S. Kirby, Byrnestown	5,546·6	271·329	Trinity Beauty's Hero	February
Broadview Royal Beauty	W. S. Kirby, Byrnestown	4,807·85	257·310	Trinity Beauty's Hero	February
Lermont Brightlass	J. Schull and Son, Oakey	4,284·1	246·223	Trinity Graceful Duke	February
Boree Effort's Briar	D. J. Louttit, Monto	9,841·5	477·59	Trinity Daffodil's Effort	March
Boree Effort's Lynette	D. J. Louttit, Monto	6,809·5	375 005	Trinity Daffodil's Effort	March
Ashview Ladyette	C. Huey, Sabine	6,043·0	322·553	Trecarne Some Tot's Duke 2nd	March
Oxford Valerie 3rd	E. Burton and Sons, Wanora	6,397·3	289·272	Oxford Franklyn	March
Oxford Lottie	E. Burton and Sons, Wanora	5,865·4	287·457	Oxford Franklyn	March
Inverlaw Syrian Viola	R. J. Crawford and Sons, Kingaroy	4,927·75	280 809	Oxford Royal Lad	March
Mabreen Belle	V. Dunstan, Wolvi	5,406·05	277·377	Trinity National Design	March
Coraldale Rainbow	W. A. White, Malanda	5,661·3	276·847	Peeramon Noble	March
Westwood Cheviot	F. Porter, Cambroon	4,443 05	276·395	Trecarne Golden King 2nd	March
Woodview Birdie	L. E. Marsden, Canaga	4,928 9	270·749	Ashview Peer	March
Romsey Fancy	J. Wilton, Killarney	5,274·5	258·5	Oxford Flying Fox	March
Lermont Queen 2nd	J. Schull, Oakey	4,493·8	253·271	Lermont Fair Lad	March
Brooklands Regal Prunella	W. S. Conochie, Sherwood	4,842·05	240 964	Brookland Regalia	March
	GUERNSEY. MATURE COW (STANDARD 350 LB.).				
Fernhill Ivy (345 days)	H. Sanderson, Monto	9,338·75	495 543	Laureldale Pluto	January
Fernhill Hollyhock (365 days)	H. Sanderson, Monto	9,789·0	493 061	Laureldale Peace Boy	January
Laureldale Dot	W. A. K. Cooke, Witta	9,232·6	446·126	Laureldale President	February
Adaville Olga (365 days)	J. M. Cooke, Witta	9,972·8	549·033	Laureldale Rockfeller	March
	SENIOR, 3 YEARS (STANDARD 290 LB.).				
Oakwood Bunny	E. G Foxton, Maleny	6,320·5	314·447	Wirrawong Winter	January
	JUNIOR, 3 YEARS (STANDARD 270 LB.).				
Oakwood Success	W. H. Doss, Degilbo	6,054·5	280·957	Fairfield Witch Boy	February
	SENIOR, 2 YEARS (STANDARD 250 LB.).				
Laureldale Baby	W. A. K. Cooke, Witta	6,454·35	348 258	Minnamurra's Topsy's Sequel	March
Laureldale Louise	L. G. McKewen, Gayndah	7,035·19	320 945	Minnamurra's Topsy's Sequel 2nd	March
Laureldale Dorothy	L. G. McKewen, Gayndah	7,591 58	320 536	Laureldale Dan	March
	JUNIOR, 2 YEARS (STANDARD 230 LB.).				
Linwood Delight	E. G. Foxton, Maleny	5,042 75	277·685	Wirrawong Winter	January
Golden Rae Princess	L. G. McKewen, Gayndah	6,003·3	280·07	Linwood Winkle	February
Brynworth Cordelia	A. A. Huth, Roadvale	4,876·2	243 571	Moongie Bonnie Willie	March
	ARYSHIRE. MATURE COW (STANDARD 350 LB.).				
Eleresley Fuss 2nd	Stimpson's Ltd., Loganlea	9,311·95	397·289	Benbecula Banker	March
	SENIOR, 4 YEARS (STANDARD 330 LB.).				
Eleresley Jonqruh	Stimpson's Ltd., Loganlea	8,124 35	357·617	Eleresley Major 2nd	March
	FRIESIANS. MATURE COW (STANDARD 350 LB.).				
St. Athan's Sunny Molly	C. H. Naumann, Yarraman	12,444·8	439·131	Tent Hill Sunlight	March

When Should Baby Stand and Walk?

AT about 5 months of age most babies learn to turn over; first from the stomach to the back and later from the back to the stomach. When baby is placed on his stomach he kicks and squirms and sometimes discovers that he can push his body forwards by the movement of his arms and legs. Gradually, as he gets older, his muscles become stronger and he begins to creep—a movement similar to the walking of animals.

The age at which baby puts all his weight on his feet and stands up may be any time from 7 to 10 or 11 months. The average baby develops his own mechanisms with very little help and parents should assist, not by sitting or standing baby up before he is ready, but by providing the necessary incentives to development as well as—and this is *very important*—the right foods to build up strong bones and muscles.

Do not hamper baby with too many clothes or too tight napkins or panties. A play-pen is very useful and can be made by any handy man. The pen can first be used to encourage vigorous kicking and rolling exercise on a hard surface, which aids so much in muscle development. The sides of a play-pen are excellent for baby to learn to pull himself up, and if brightly coloured toys (strings of cotton reels coloured with vegetables dyes do quite well) are hung on the sides baby will be inspired to move around and examine them one by one.

When finally baby takes those first steps by himself—probably somewhere between 12 and 15 months—the parents must learn to be patient.

A baby who is just learning to walk will be wobbly in his gait and will look very clumsy. He keeps his knees stiff and his feet far apart and he will hold his arms stiff and use them for balancing. In spite of these precautions he will fall frequently until he gains control of his muscles.

Remember, it is baby who is learning, so let him shoulder his own responsibilities and face up to his own mistakes. Do not be over-sentimental about his tumbles—they have to come. Walking is a complicated mechanism, and baby has to learn not only to get his balance on the straight but to negotiate corners, climb elevations, and so on. He even has to allow for unexpected obstacles such as a slippery patch, a moving rug, or a strolling cat. Take reasonable precautions, but do not over-protect baby. He will not be afraid if he is encouraged and allowed to realise that it is his own lack of practice that is at fault and he really *is* improving.

Such conditions as severe illness or prematurity may make a baby late in learning to walk, but if he cannot walk by his second birthday he should be examined by a doctor to see what is holding him back.

Any parents who have problems on this and other matters connected with children may obtain further information by communicating personally with the Maternal and Child Welfare Information Bureau, 184 St. Paul's Terrace, Brisbane, or by addressing letters "Baby Clinic, Brisbane." These letters need not be stamped.

ASTRONOMICAL DATA FOR QUEENSLAND.

AUGUST, 1949.

By W. J. NEWELL, Hon. Secretary of The Astronomical Society of Queensland.

TIMES OF SUNRISE AND SUNSET.

At Brisbane.			MINUTES LATER THAN BRISBANE AT OTHER PLACES.					
Day.	Rise.	Set.	Place.	Rise.	Set.	Place.	Rise.	Set.
	a.m	p.m.						
1	6.30	5.18	Cairns	17	41	Longreach	29	40
6	6.27	5.21	Charleville ..	26	28	Quilpie	36	34
11	6 23	5.23	Cloncurry	44	58	Rockhampton ..	4	16
16	6.19	5.26	Cunnamulla ..	30	28	Roma	16	18
21	6.14	5.28	Dirranbandi ..	21	17	Townsville ..	15	35
26	6.10	5.31	Emerald	14	24	Winton	33	47
31	6.04	5.33	Hughenden ..	26	44	Warwick	5	3

TIMES OF MOONRISE AND MOONSET.

At Brisbane.

Day.	Rise.	Set.
	a.m.	p.m.
1	10.40	..
		a.m.
2	11.19	12.10
	p.m.	
3	12 01	1.16
4	12.49	2.22
5	1.43	3.26
6	2 42	4 26
7	3 43	5.19
8	4.44	6.05
9	5.43	6.45
10	6.40	7.19
11	7.34	7.50
12	8.26	8 18
13	9.17	8.44
14	10.10	9.11
15	11.03	9.40
16	11.58	10.10
17	..	10.45
	a.m.	
18	12.56	11.25
		p.m.
19	1.55	12·12
20	2.55	1.07
21	3.52	2 09
22	4.45	3 15
23	5 33	4.24
24	6.15	5.33
25	6.54	6.41
26	7.29	7.47
27	8.04	8.53
28	8.40	10.00
29	9.18	11.08
30	9.59	a.m.
31	10.46	12.15

MINUTES LATER THAN BRISBANE (SOUTHERN DISTRICTS)

Charleville 27; Cunnamulla 29; Dirranbandi 19;
Quilpie 35; Roma 17; Warwick 4.

MINUTES LATER THAN BRISBANE (CENTRAL DISTRICTS).

Day.	Emerald.		Longreach.		Rockhampton.		Winton.	
	Rise.	Set.	Rise.	Set.	Rise.	Set.	Rise.	Set
1	24	13	40	29	15	3	46	32
6	30	9	46	23	21	1	54	26
11	22	15	38	31	13	6	43	35
16	12	25	27	41	2	17	30	49
21	9	30	25	45	0	21	26	53
26	18	19	34	35	9	10	38	39
31	30	9	45	24	20	0	53	26

MINUTES LATER THAN BRISBANE (NORTHERN DISTRICTS).

Day.	Cairns.		Cloncurry.		Hughenden.		Townsville.	
	Rise.	Set.	Rise.	Set.	Rise.	Set.	Rise.	Set.
1	41	14	57	40	42	25	34	14
3	51	8	65	36	49	21	42	8
5	56	2	68	32	52	17	46	3
7	54	4	67	33	51	19	44	5
9	45	10	61	37	46	23	37	10
11	35	20	54	44	39	29	29	18
13	26	31	47	51	32	36	22	26
15	16	40	41	58	26	43	14	34
17	11	49	38	63	23	49	10	41
19	3	56	34	67	18	53	4	46
21	2	55	33	67	17	52	3	45
23	9	47	37	62	21	47	8	39
25	20	35	44	55	29	40	18	30
27	33	22	52	45	37	30	27	19
29	44	12	61	38	45	24	37	12
31	54	3	67	32	51	18	44	4

Phases of the Moon.—First Quarter, 1st August, 10.57 p.m.; Full Moon, 9th August, 5.33 a.m.; Last Quarter, 17th August, 8.59 a.m.; New Moon, 24th August, 1.59 p.m.; First Quarter, 31st August, 5.16 a.m.

On 15th August the sun will rise and set 16 degrees north of true east and true west, respectively, and on the 12th and 26th the moon will rise and set approximately at true east and true west, respectively.

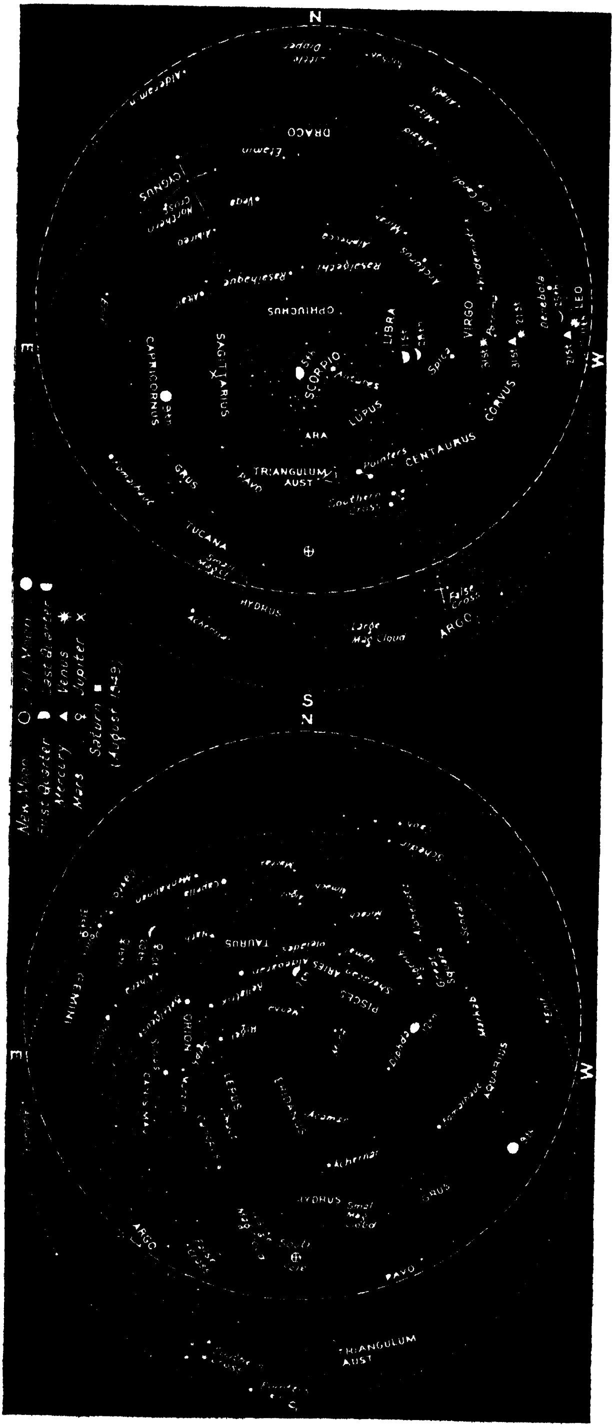
Mercury will be an evening object all this month. On the 1st, in the constellation of Cancer, it will set only 25 minutes after the sun, but by the end of the month, in the constellation of Virgo, it will set nearly 2 hours after sunset, reaching greatest angle east of the sun early next month. This is a most favourable time to observe Mercury.

Venus.—Now a brilliant object in the western evening sky, where it will remain for some time. At the beginning of the month, in the constellation of Leo, it will set 2 hours 8 minutes after the sun, and by the end of the month, in the constellation of Virgo, will set 2 hours 39 minutes after the sun.

Mars.—In the constellation of Gemini all this month; at the beginning, rising 2 hours before the sun; and at the end, rising about 40 minutes earlier.

Jupiter.—Continues to be an easily observed object during the month, being in a region of the sky where no particularly bright stars are situated. It can be observed for the greater part of the night.

Saturn.—Though at the beginning of the month this planet sets between 7.15 p.m. and 8.30 p.m., at the end of the month it will set only 8 minutes after the sun, so for the greater part of the month it will be too close to the sun for observation.



Star Charts.—The chart on the right is for 7.15 p.m. in the south-east corner of Queensland to 8.15 p.m. along the Northern Territory border on the 15th of August. (For every degree of longitude we go west, the time increases 4 minutes.) The chart on the left is for 10 hours later. On each chart the dashed circle represents the horizon as viewed from Cape York and the dotted circle the horizon for places along the New South Wales border. When facing north, hold "N" at the bottom; when facing south, hold "S" at the bottom; and similarly for the other directions. Only the brightest stars are included and the more conspicuous constellations named. The stars, which do not change their relation to one another, moving east to west, arrive at any selected position about 4 minutes earlier each night. Thus, at the beginning of the month the stars will be in the positions shown about 1 hour later than the time stated for the 15th, and at the end of the month about 1 hour earlier than that time. The positions of the moon and planets which are continually changing in relation to the stars, are shown for certain marked days. When no date is marked the position is for the middle of the month.

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Contents

Agriculture on the Darling Downs.

J. HART, Adviser in Agriculture, Agriculture Branch.

(*Continued from page 9 of the July issue.*)

THE INFLUENCE OF SOIL, CLIMATE, AND VEGETATION ON DARLING DOWNS AGRICULTURE.

THE form of agriculture practised on the Darling Downs has been governed to a large extent by a combination of factors, the more important of which are as follows:—

1. The major soil type is self-mulching, with good moisture retaining capacity.
2. The climate of most of the Downs is characterised by an average annual rainfall of approximately 26 inches, more usually a dry winter and hot summers with erratic storm rains.
3. Although winter herbage may flourish, pastures are essentially summer growing.

Because of the rainfall distribution and extremes of temperatures, efforts to establish a permanent pasture grass, or mixture of grasses and legumes, to supply a good body of feed during both the summer and winter months of the year over most of the Downs country have been unsuccessful to date. The lack of permanent summer and winter pastures makes this area unsuitable for intensive grazing and dairying unless special measures are taken to offset this disadvantage and so the growing of both summer and winter grain and fodder crops is essential if animals are to be included in the farm programme. Accordingly, the practice of growing supplementary crops has been adopted, but as the open plain country is devoid of protection from the cold, westerly winter winds and the hot, summer days, the pasturing of stock is largely confined to the timbered areas of the eastern and western Downs country, leaving the open downs for grain production.

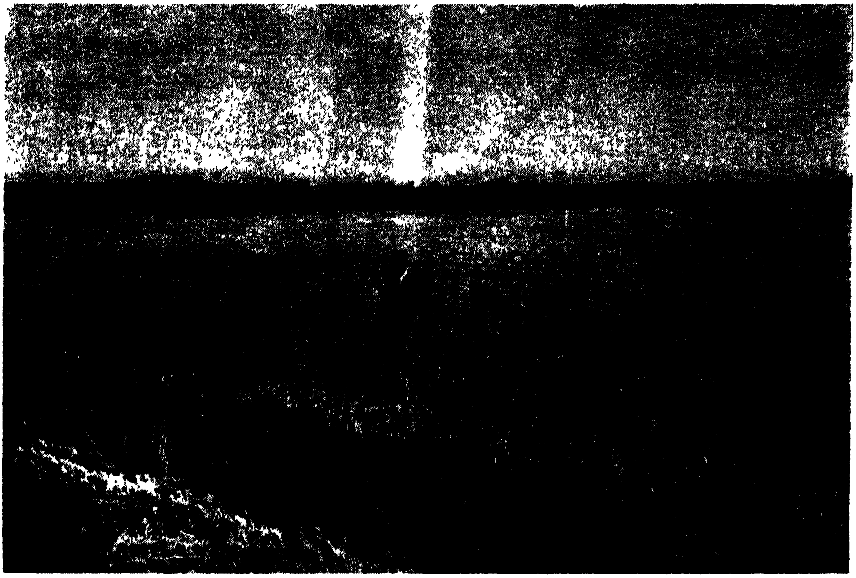


Plate 18.
SEAFOAM WHEAT, ALLORA DISTRICT, EASTERN DOWNS.

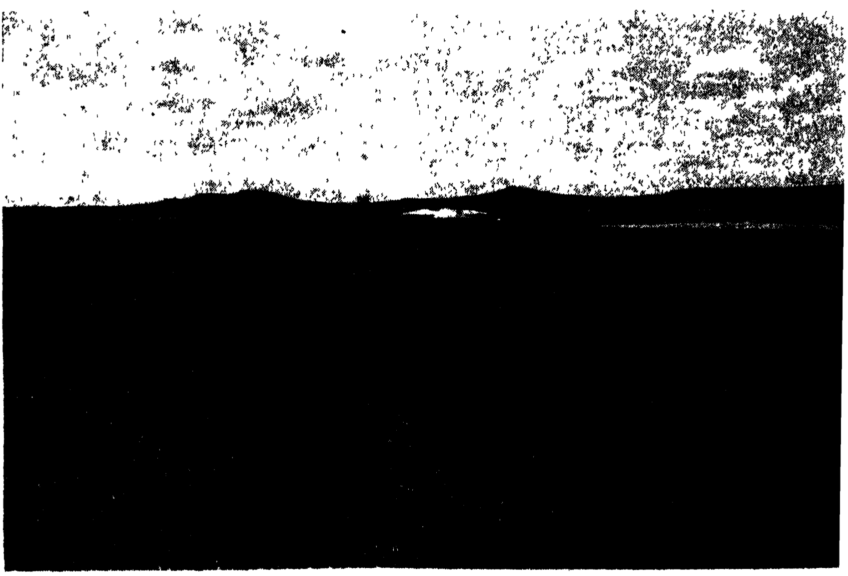


Plate 19.
WHEATFIELDS, PILTON DISTRICT, EASTERN DOWNS.

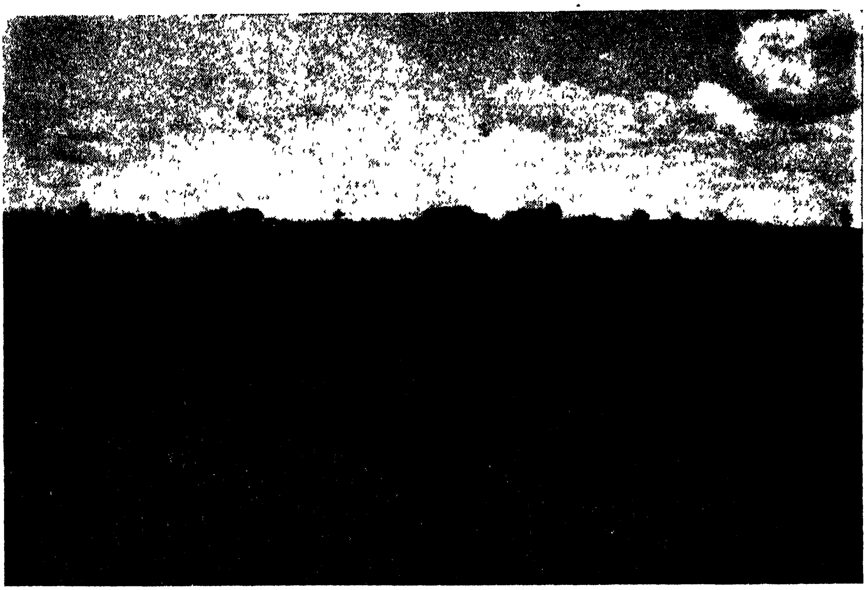


Plate 20.

CANARY SEED CROP, CAMBOOYA, EASTERN DOWNS.

Wheat is the major crop in the grain growing areas. That a winter crop should fill this role in an area of little winter rainfall is perhaps surprising, but this has been brought about by soil and climatic factors. Firstly, summer rain is unreliable, while heat waves are often injurious to crop growth; secondly, the black earths, with their high clay content and self-mulching tendency, are ideal for fallowing and conservation of moisture.

It is, therefore, the usual practice on the Darling Downs to conserve the moisture from summer rains by fallowing, utilising such moisture for wheat production during the winter. Two suitably spaced falls of rain during the growing period of the crop are usually sufficient to ensure a profitable return of grain. That this method of agriculture has proved satisfactory for the area is instanced firstly by the fact that there has only been one complete wheat crop failure on the Downs in the past 13 years, and secondly by the fact that the Queensland average yield per acre is higher than that of any other State in Australia.

Summer grain crops are important in the cropping programme and it is a general practice for limited areas of summer crops to be grown annually. However, it is only following the partial or complete failure of the wheat crop that summer cropping becomes a major part of the farming programme of the grain growing districts.

The problems associated with agricultural practices which have been developed to meet the conditions mentioned above are numerous, and include the following:—

(1) The selection of an economic crop rotation.

(2) The extension of agricultural practices designed to retain soil fertility.

(3) The establishment of a nutritionally well balanced permanent pasture.

(4) The incorporation of effective soil conservation practices in the farming programme, where required.

The objectives of (1) and (2) are similar but their application is limited by an economic factor. For example, a rotation of wheat followed by a row crop and then lucerne would perhaps be effective in satisfying (2) above, but where wheat can still be profitably grown on the same land year after year a farmer adopting such a programme would suffer financial loss, especially during the present era of high grain prices. Again, burning the wheat stubble is commonly practised on many farms for the purpose of facilitating cultivation and the preparation of the seed-bed for the next wheat crop. This is almost universally accepted as an undesirable practice, but because there is, as yet, little apparent deterioration in soil fertility and wheat yields in the main grain areas, trash conservation is not regarded as economic by most farmers on the Darling Downs.

The main farming activities on the Darling Downs may be grouped as (1) grain growing; (2) dairying and mixed farming; and (3) crop fattening—sheep and cattle. These activities are discussed in the following sections.

GRAIN GROWING.

The grain crops grown may be divided into two well-defined groups—winter crops and summer crops. The former includes wheat, oats, barley, linseed and canary seed; the latter, grain sorghums, millets, maize and sunflowers.

Farms in the grain growing areas vary considerably in area, but generally range between 600 and 1,000 acres, with occasional properties up to 1,500 acres. The farm plant varies with acreage, but would include one or more of each of the following:—tractor, sundercut, scarifier, stump-jump harrows, combine, header-harvester and a medium-sized motor vehicle. The outlay for plant alone would, on present day prices, approximate £3,000. Where larger than average areas are farmed, the outlay for machinery would be considerably greater.

Wheat.

The wheat industry in Queensland is well organised. Between the two world wars the marketing of the State wheat crop was subject to the operation of the Wheat Pools Act under which the State Wheat Board was constituted. This Board performed all the marketing functions on behalf of the growers. During the second world war, the industry was subject to the control of the Australian Wheat Board, operating under emergency legislation. Since the enactment of the Wheat Industry Stabilisation Act of 1948 the Queensland wheat industry has been incorporated as an integral part of the Commonwealth stabilisation plan in which the State Wheat Board retains autonomy. The State Board selects, grades and distributes seed wheat, covers compulsory hail insurance on crops, procures and delivers bags for harvesting, and stores the grain.

The crop, mainly planted in June, is normally harvested in November. As the summer storm period usually commences in November, an essential requirement of wheat growing in this area is the rapid clearing of the harvested grain to the wheat dumps.

Three desirable characteristics of wheat varieties for the Downs are rust resistance, drought resistance and earliness of maturity. Varietal improvement along these lines is continually being investigated by plant breeders of the Department of Agriculture and Stock and today growers have a number of excellent wheat varieties from which to choose when arranging their plantings.

The area sown to wheat during 1948 was approximately 630,000 acres, giving an estimated yield of about 14 million bushels. Individual yields of up to 60 bushels per acre were recorded in this season, but an average yield per acre on good wheat land on the Darling Downs over a number of years would be in the vicinity of 21 bushels.

Oats, Barley, and Canary Seed.

These crops, which require a similar mode of handling to wheat. are grown in conjunction with that crop, but are more commonly used as winter fodders. Oats, in particular, are used for this purpose since the Downs has not proved as suitable for oat grain production as the oat districts of the southern States. The estimated production of these grains on the Downs for the year 1948 is as follows:—

	Acres	Bushels
Oats	9,000	240,000
Barley	4,000	150,000
Canary seed	5,000	60,000

The areas planted to these crops vary considerably from year to year, the acreages depending on the current market values of the grains, particularly in the case of canary seed.

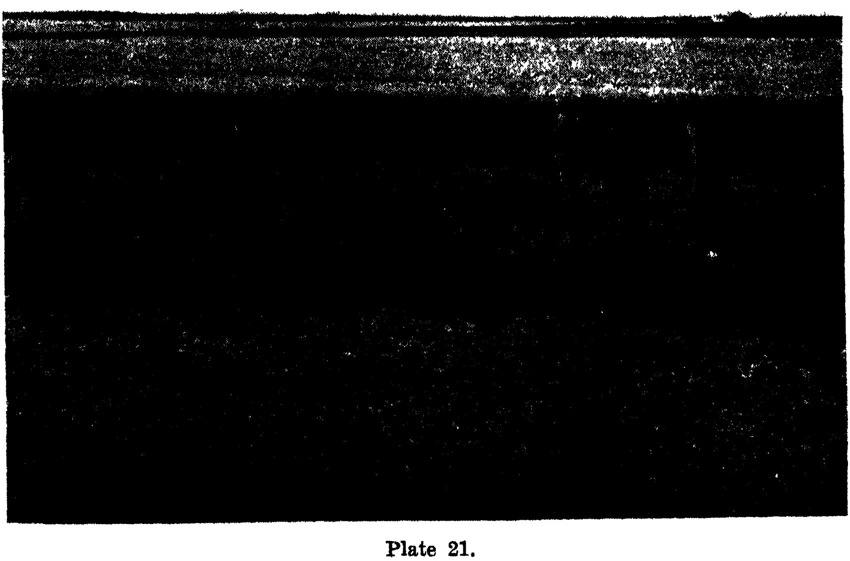


Plate 21.
WHEATFIELDS ON PLAIN COUNTRY IN THE DALBY DISTRICT.

Linseed.

At present, linseed is in its early stages of establishment as a commercial crop on the Darling Downs. Results to date indicate that linseed can be grown successfully in this area and expansion of the industry is expected if prevailing high seed prices continue. The crop can be handled entirely by wheat farm machinery and this factor alone greatly favours crop expansion.

The area sown to linseed on the Downs in 1948 was approximately 6,000 acres. An average yield of 6 to 9 bushels per acre was well below the previous season's yield of 12 to 15 bushels per acre from approximately 150 acres. This reduction in yield was almost wholly due to corn ear worm attack. This pest atacked the crops soon after flowering commenced, the larvae causing considerable damage to the developing seed bolls Control of the pest can be obtained by spraying or dusting with DDT. The large areas are suitable for aerial treatment with the insecticide, but for smaller areas power-driven dusting or spraying plants mounted on suitable vehicles are sufficient.

The outbreak of corn ear worm in this crop was exceptionally heavy in 1948, but such serious infestations are not normally expected. The susceptibility of linseed to this pest, however, may be a limiting factor to its expansion.

Investigation of cultural methods such as time of planting and seeding rate offer hope for control of the pest. Brief experience to date suggests that crops planted in late autumn or early winter are less liable to severe pest losses than crops planted later.

Grain Sorghum.

Dwarf varieties of this crop were first grown commercially on the Darling Downs in 1939. The superiority of grain sorghum to maize in both yielding capacity and drought resistance, together with the adaptability of the dwarf types to working with normal wheat farm machinery, are responsible for the popularity the crop has enjoyed since its introducion. As mentioned previously, the area sown to this crop fluctuates according to success or failure of the wheat crop.

A conservative average yield of grain sorghum would be 30 bushels per acre, but crops of 120 bushels per acre have been recorded in the district. The average yield of 40 bushels per acre for the 1946-47 crop was phenomenal in that two crops were harvested from the one planting in many instances, due entirely to unusually favourable seasonal conditions.

Normally, the crop is planted as early in summer as possible. Late sown crops are liable to be heavily infested with sorghum midge and suffer severe damage or even total loss.

Maize.

The popularity of maize has declined since the introduction of grain sorghum, the estimated area on the Downs during the 1947-48 season being 7,000 acres, producing 70,000 bushels of grain. The uncertainty of summer rains on the Darling Downs is unfavourable to maize production, as the crop requires rain at the flowering stage for cob development. In contrast, grain sorghum is more resistant to dry conditions.

An average yield of maize would be 18 to 24 bushels per acre, but yields of up to 60 bushels have been recorded. Generally speaking, there are two planting periods for this crop—early summer and mid-summer (that is, late September and January). These planting times have been arranged so that final development of the plant is possible either before or after the harsh conditions of midsummer.

Maize is not a crop of the main grain-producing areas, its culture generally being confined to mixed farming areas of the eastern and north-eastern portions of the Downs. Although it can be harvested fairly satisfactory by the sturdier makes of header-harvester, and although some special maize picking machines are operated in the area, the general practice is to hand-pick the cobs, which are later threshed out through a stationary thresher.

Hybrid maize varieties suitable for the various maize districts of the Downs are being evolved by the Queensland Agricultural High School and College and it is anticipated that within a few years seed will be available for large commercial plantings. The yield increase already shown by hybrid varieties tested may revive the popularity of this crop. However, in the light of present day comparisons between the two crops, maize and grain sorghum, it is difficult to see the former replacing the latter as a crop in the grain growing districts of the Darling Downs.

Millets.

Under this group come the following types, all of which are grown in varying amounts over the Darling Downs:—Setaria (panicum), white panicum, white French millet, Japanese millet and Hungarian millet. Of these, setaria, white French and Japanese millets are the most popular in this area, the acreages and yields for the 1947-48 season being estimated as under—

	Acres	Bushels
Setaria (panicum) .	5,000	165,000
White French	5,000	115,000
Japanese	3,000	105.000

Setaria (panicum) and white French millet are grown almost solely for grain whilst the other types serve a dual purpose, being grazed and then allowed to go to seed. These latter types are more commonly grown on the mixed farming areas of the Downs.

Sunflowers.

It is estimated that approximately 5,000 acres of sunflowers were sown during the 1947-48 season. This hardy summer crop, giving an average yield of one half-ton of seed per acre, is becoming increasingly popular. It is, perhaps, the most drought resistant of all cultivated summer crops on the Downs, and this characteristic, coupled with the suitability of the crop for handling by wheat farm machinery, is a major cause of its increased popularity.

At present, Giant Russian is the variety in general production, but the suitability of mid-dwarf and dwarf varieties such as Mennonite and Sunrise is being investigated. These varieties are more easily handled by the header-harvester than Giant Russian.

Killarney and Nobby are the two chief sunflower growing areas of the Downs, but expansion to other districts is highly probable.

HORTICULTURAL CROPS.

Apart from a few small crop or truck crop areas in or around the main centres, horticultural crops are of no appreciable commercial value on the Darling Downs. However, most vegetable and temperate fruits grow quite readily in the district.

WEED PROBLEMS.

A number of weeds of considerable economic importance occur on the Darling Downs, the most important being mint weed (*Salvia reflexa*), wild turnips (*Raphanus raphanistrum* and *Rapistrum rugosum*), Johnson grass (*Sorghum halepense*), nut grass (*Cyperus rotundus*), and a number of deep-rooted weeds, such as *Senecio* sp. and *Centaurea* sp. which only recently have been reported as being troublesome.

Mint Weed.

Although most serious on the black earths of the Downs, mint weed grows on all soil types found in the area. The main conclusions reached by officers of the Commonwealth Council for Scientific and Industrial Research following a survey of the mint weed problem in 1946 and 1947 were as follows:—

(1) Losses of grazing animals from poisoning can be avoided if precautions are taken to prevent hungry stock entering dense mint weed.

(2) Pastures are not invaded unless the vigour of the stand has been reduced by mismanagement. Once the weed is established in a pasture its dominance is assured unless the intensity of grazing is greatly reduced.

(3) Mint weed is not normally of importance in wheat growing or in the production of winter fodder crops. With summer cereals, on the other hand, mint weed is often able to dominate a crop in the early stages of its establishment.

Mint weed, like other annuals, can be kept in check by cultivation, but the most efficient cultural practices in seed-bed preparation and inter-row tillage have not yet been determined. Urochloa grass has in some areas choked out the mint weed, but except on the eastern fringe, where the grass itself is becoming a pest of cultivations, it does not usually grow sufficiently vigorously to control the weed.

Hormone-type weedkillers are effective against mint weed, but the question of using these weedicides on an extensive scale against a free-seeding annual is an economic one.

Wild Turnips.

These winter growing weeds, commonly found over most of the open downs country, are pests of major economic importance to the wheat grower. As well as being serious competitors of the cereal crop itself, they produce woody seed stalks which present a difficult problem to the wheat harvesting machinery.

These pests can now be effectively controlled by the use of hormone-type weedkillers at a cost approximating 3s. per acre for materials. Best results are obtained while the plants are in the seedling stage. A machine capable of spraying 100 acres a day can readily be constructed on the farm.

Johnson Grass.

Johnson grass, a member of the sorghum family, is a fairly prevalent pest in the eastern Downs districts, having been introduced often among Sudan grass seed. The plant is similar in general appearance to Sudan grass but has a strongly developed system of rhizomes, or underground creeping stems, which persist after the aboveground portions are destroyed. It is generally considered to be the most poisonous of all the sorghum group.

Eradication by cultural methods alone is difficult and impracticable. A solution of sodium chlorate at a concentration of 1 lb. to 1 gallon of water will effectively control this weed, although the material is expensive. However, for controlling small patches of Johnson grass its use is strongly recommended.

Nut Grass.

Because of the rather severe winters on the Darling Downs, the introduction of nut grass was not viewed with much concern. However, in recent years it has attained some importance on the eastern Downs soils, where on some farms it has become a major pest. It has proved to be a serious competitor for moisture among summer crops, while summer fallowing for winter crops may be rendered ineffective by its presence. There is no known practical control for this pest.

DAIRYING AND MIXED FARMING.

Generally speaking, dairying on the Darling Downs is confined to the sheltered timbered zones previously mentioned. There are two distinct district areas:—

(*a*) the undulating and hilly country of the eastern, north-eastern and northern Downs, with centres such as Toowoomba, Oakey, Crow's Nest, Pittsworth and Warwick;

(*b*) the brigalow-belah and open box country of the western and north-western Downs, with centres such as Dalby, Bell, Jandowae and Warra.

The dairying industry, though well organised as far as factory distribution is concerned, is less amenable to efficient management than is the grain growing industry. This can be attributed, perhaps, to the fact that dairying, more especially in the eastern zone, is generally conducted in association with mixed farming. It is obvious that, where a farmer has to cultivate both summer and winter fodders, the temptation to utilise these crops as cash crops whenever possible is great and this is quite often to the detriment of the herd. In spite of this disadvantage, however, the annual return per cow on the eastern Darling Downs is higher than that of any other district in the State, being in the vicinity of 200 lb. of butterfat per year. In most other Queensland districts, however, permanent pastures are established, so the higher production on the Downs is offset to some extent by necessary cultivation and cropping costs.

The Eastern Districts.

These districts are first class dairying areas, the lack of good winter rains being their main drawback. It is considered that a more stable dairying industry could be effected by the inclusion of more fodder conservation in the farming programme and more efficient cropping and grazing of fodder crops.

If farmers would set aside a percentage of cash crops towards the building up of reserve fodder, the problem of fodder conservation would be largely overcome. Silos in general, because of the time, labour and expenditure in installing, filling and emptying, are not favoured by farmers in these districts, where much time is involved in the cultivation of the land to produce the necessary all-the-year-round fodder. An alternative is the inclusion of lucerne stands in the cropping programme and the storing of hay therefrom. When not required for hay such stands can be grazed. Lucerne hay fed with sorghum grain, which is produced on most dairy farms, would supply a very useful ration to tide stock over the dry periods usually experienced in this area.

With the introduction of the pick-up hay baler, the making and storage of hay has become a simple matter. Whilst these machines are generally too expensive for individual farmers to purchase, co-operative machinery pools can effectively control and profitably maintain them. The Darling Downs Co-operative Dairy Association has two such pools in operation at the present time, one pool working the eastern Downs and one the western area. Pick-up balers owned by other machinery pools and private contractors also operate throughout the area.

The normal size of dairy farms in these districts would vary from 120 to 320 acres, with some farms over 500 acres in area. Carrying capacity is largely dependent on the extent to which the owner indulges in mixed farming. An average holding would carry about one beast to six acres. It is emphasised that this capacity could be increased if the farmer were to concentrate solely on dairying. The original outlay in equipping such a farm is, as in the grain growing areas, fairly high. Similar implements are required for the land cultivation, but not, of course, as large as those used in the grain growing districts.

The bulk of the farm dairy produce is made into butter, factories being established at Crow's Nest, Goombungee, Oakey, Toowoomba, Clifton, Allora, Killarney and Warwick. Thirty-one cheese factories are scattered over the area, but mostly around Pittsworth and the Maclagan-Quinalow districts, and there is an increasing fresh milk supply trade. Brisbane distributing and processing firms are already being supplied with milk from this area.

Pig raising is associated with dairying except where a farmer is supplying fresh milk. The pig industry is extremely valuable in this area. The Darling Downs Co-operative Bacon Association, which handles much of the Darling Downs output, killed 100,000 pigs during 1946-47 and 67,000 during 1947-48 at its Downs factory. During 1947-48, the wholesale selling value of its products was over £780,000.

The main cultivated fodder crops used in the eastern dairying districts are wheat, oats, barley, and canary seed as winter feeds, and Sudan grass, Japanese millet and lucerne as summer fodder. It is only during a mild winter that lucerne supplies a body of feed during this time of the year. Although grazing of Sudan grass is a long established practice over the whole of the Downs, it must be emphasised that this grass, like all other members of the sorghum group, may be poisonous to cattle at certain periods, more especially when the plants are wilted during a dry spell. A supply of one of the effective antidotes to this poison should be kept on hand.

The Western Districts.

This group of districts, which embraces much of the brigalow-belah and open box country, is mainly an area of permanent pastures. Here, as previously mentioned, Rhodes grass is the major fodder. Recent years, however, have seen the introduction of some crop cultivation for both winter and summer fodders.

The problems outlined for the eastern districts apply to this area also. An outstanding need is the inclusion of a suitable legume in the Rhodes grass pastures. At the present time, lucerne is considered the most satisfactory.

Farm size in these areas is much larger than in the eastern districts, varying from 600 to 1,000 acres and over; but here, where the pasture grass is mainly summer growing, the carrying capacity of the land is necessarily reduced to enable the stock to carry over during the winter months. Carrying capacity of these areas is about one beast to 6–8 acres. This carrying rate compares favourably with that of the eastern districts, but it must be remembered that whilst farmers in the latter area indulge in mixed farming western district farmers concentrate almost solely on dairying.

The return per cow in this area averages about 160 lb. of butterfat per year. Output, of course, fluctuates, being high in the summer months and low during the winter period, while that of the eastern districts is comparatively regular throughout the year.

Practically the whole of the dairy farm produce is manufactured into butter by the factories at Jandowae and Dalby. Cheese production is of little account, the only factories in the area defined as the western districts being at Yamsion, Irvingdale, Sunnyvale and Cooranga North.

The distance of these centres from the big cities gives little opportunity at present for a fresh milk trade.

CROP FATTENING.

Crop fattening of sheep and cattle is becoming an important industry on the Darling Downs, and is generally conducted in conjunction with grain growing. At present, emphasis is on the production of grain, with crop fattening filling a secondary role. It is natural, of course, that the relative popularity of grain production and cattle fattening should be wholly determined by the relative prices of grain and meat. The two industries, however, can be combined with considerable success.

Important factors in successfully combining grain growing with crop fattening are, firstly, the purchasing of stock from western Queensland districts during the late summer or early winter months and selling on the high market of late winter; secondly, the selection of dual purpose cereal varieties which will supply a heavy body of feed and still give good grain yields; and thirdly, well organised grazing methods.

The matter of purchase and sale of stock is entirely the concern of the individual farmer, but in purchasing a buyer must be sure that his crop is sufficiently rooted to withstand grazing and that he will have enough green fodder to carry the beasts through to their peak

condition. Should the latter not be achieved, the low prices received for the animals may be insufficient to offset the loss of grain occasioned by the grazing of the crop.

Wheat (Plate 22), oats and canary seed are the popular crops used for fattening. Oats are quite often planted solely for feed purposes, whilst wheat is generally planted with the object of obtaining a grain crop after being grazed. Most of the commoner oat varieties have proved satisfactory, the popular choices being Fulghum and Algerian. Victoria x Richland and Klein, two newly introduced varieties, are rapidly coming into favour.

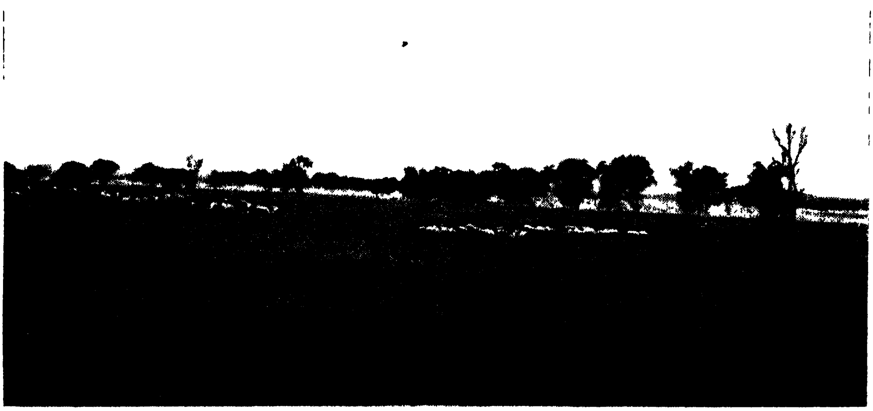


Plate 22.
LAMBS BEING FATTENED ON WHEAT.

Slow maturing wheat varieties evolved for the dual purpose of grazing and grain production are available, the most popular being Warput and Ford. Yalta is a new rust-resistant variety from New South Wales which also appears suited for this purpose, and Florence x College is a new Queensland strain which is highly resistant to rust and gives great promise as a dual purpose variety for early planting.

In the grazing of crops intended for grain, a number of points require attention. Rapid feeding-off with a large number of animals is preferable to an extended grazing by a small herd or flock; grazing should not commence until plants are firmly rooted, as young plants are easily pulled out by sheep and cattle; to reduce trampling damage, stock should not be allowed to graze in crops during wet weather if it can be avoided; and finally, in crops intended for grain, grazing should cease before the developing heads, sheathed within the leaf stems, are high enough from the ground to be eaten by stock.

Quality of Seeds for Sowing.

F. B. COLEMAN, Standards Officer, Standards Branch.*

SEED can be defined as "The germ from which a plant can be reproduced."

It is an interesting experiment to take a few bean seeds and place them on a plate covered with very damp cloth, flannelette or towelling. If the seed is covered with another plate to retard evaporation, and kept warm, root and stem growth can be watched every day.

As the root and stem grow, it will be observed that the seed leaves grow smaller, their function being akin to a "baby's bottle" which enables the little plant to live until it has established itself in the soil.

After germinating in the field the plant will run its life cycle and produce another crop of seeds which can be harvested. In the process of harvesting, some inert matter and weed seeds may be unavoidably included with the seeds of the cultivated plant. Various processes of cleaning are therefore required before the seed is fit for sale.

Sampling.

The quality of seeds for sowing can be ascertained by examination of a sample to determine its composition and the ability of the seed to produce healthy root and stem growth in a given number of days.

Great care is necessary to ensure that the sample truly represents the bulk. It is therefore taken from the top, centre and bottom of as many containers as possible.

The sample to be examined is first numbered, then thoroughly mixed and spread out on a sheet of plate glass. By the aid of a spatula, several portions are lifted from different parts until a sufficient quantity is obtained to enable a purity test to be made. In the case of beans, 200 grams are required, cowpeas and wheat 100 grams, millets 30 grams and grass seeds 10 grams.

This weighed portion is then spread out, and with the aid of a small spatula the seed is divided into fractions of the seed under consideration—called purity, seeds of other crop plants, prohibited seeds, restricted seeds, weed seeds and inert matter, which includes broken seeds less than half of a complete seed in size. Each of these parts is weighed and calculations made.

In the case of barley, beans, cowpeas, maize, oats, peas, wheat, and seeds of like size, the number of restricted weed seeds per pound should be calculated, and in the case of seeds of smaller size the number of restricted weed seeds per ounce should be ascertained.

Testing.

The seed under consideration is now placed out to germinate by taking three lots—each of 100 seeds (that is, pure seed)—and spacing them evenly on a piece of moist flannelette, which has been first placed on a tray. The moisture is varied according to the seeds' requirements, and the seeds kept covered with a sheet of glass to prevent excessive evaporation. The three lots are marked A, B and C for reference purposes.

The trays must be placed in incubators suitable for the germination of the seeds concerned. Winter-growing crops require coolness, while summer-growing crops need a warm temperature. In actual practice,

* An A.B.C. "Country Hour" Talk.

alternating temperatures or controlled temperatures ranging from 68 deg. to 104 deg. F. are used.

The number of seeds which germinate—that is, produce strong, healthy roots and stems—are recorded and removed from the tray every day.

Frequently leguminous seeds which remain unswollen when the germination test is ended are met with. All or some of these seeds would germinate when placed in the soil. Therefore in the case of lucerne, cowpeas, rice beans and crotalarias, all the hard seeds, in the case of red clover half the hard seeds and in the case of other legumes one-third of the hard seeds, are included in the germination count.

Because of the very large proportion of hard seeds, and difficulties associated with germination tests brought about by the presence of moulds, the seeds of Mauritius and velvet beans are abraded before the test is made.

Normally seeds reaching maturity on the parent plant fall to the ground and germinate when conditions are suitable. Man in his haste to harvest the seed often defeats Nature's object and the seed may be offered for sale before it is fully mature. If such seed is stored under good conditions, maturation is usually reached by the time of sowing.

Short cuts to hasten maturity, such as pre-chilling, drying, etc., are used in seed testing stations in order to ascertain the maximum possible germination of seeds such as Rhodes grass, paspalum, prairie grass and oats.

Comparison of Seed Lots.

From the records made, particulars regarding speed and uniformity of germination may be obtained, in addition to total germination percentages. The percentage of "pure germinating seed"—that is, the proportion of the bulk that will grow (which is a true indication of the value of a seed sample)—is based on purity and germination, and is obtained by multiplying the percentage of pure seed by the percentage of germination and dividing by 100.

The result enables a comparison to be made of various lots of seed with differing purities and germination, and also shows if the sample complies with the prescribed standards. For example, two samples of seed of like purity and different germination are offered for sale at 3s. 6d. and 3s. 3d. per lb. They have a pure germinating seed figure respectively of 95 per cent. and 74 per cent. Thus you would pay 3s. 8¼d. for every pound of pure germinating seed in the first sample and 4s. 4¾d. in the case of the lower priced seed. The so-called "cheaper" line is actually 8½d. per lb. dearer than the so-called "dearer" line, when the actual amount of seed that will grow is taken as the basis of calculation.

Taking 1 lb. of average lucerne seed as containing 210,000 seeds, each pound of seed as purchased should in the case of the 3s. 6d. per lb. seed produce 199,500 plants, and the 3s. 3d. per lb. seed 155,400 plants.

If these two samples were sown at the rate of 12 lb. per acre of pure germinating seed—the actual seed that will grow—100 lb. of the 3s. 6d. seed would plant approximately 8 acres, and 100 lb. of the 3s. 3d. seed would plant approximately 6 acres.

Seeds for sowing should be free from impurities, of high germination, and of known strains. Price is a secondary consideration to keen farmers who are interested in quality.

Plate 23.

LINSEED VARIETY TRIAL, REGIONAL EXPERIMENT STATION, HERMITAGE, 1948.—Varieties (from left to right)—Meggitts' Walsh, Bolley Golden, Morocco.

Plate 24.

TOBACCO EXPERIMENT PLOT, REGIONAL EXPERIMENT STATION, AYR.

Horticultural Districts of Queensland.

1.—THE GRANITE BELT.

F. A. L. JARDINE, Adviser in Horticulture.

WHAT is in some ways the most important fruit and vegetable growing district in Queensland is situated on the southern border of the State 200 miles south-west of Brisbane. This area is widely known as the Granite Belt and extends from Wallangarra on the border of Queensland and New South Wales in a northerly direction to Dalveen, a distance of 40 miles. The district varies in breadth from 5 to 17 miles. Stanthorpe (Plate 25) is the chief town serving the business and other needs of the district.. Excellent roads connect Stanthorpe to Brisbane and the main coastal resorts of southern Queensland.

Plate 25.

VIEW OF THE TOWN OF STANTHORPE, MAIN BUSINESS CENTRE OF THE GRANITE BELT.

The Granite Belt first came into prominence as a tin producing area about 70 years ago. Fruit and vegetable production commenced some 30 years later, but progress was comparatively slow until a rapid development took place after the first World War when many ex-servicemen and others settled in the area. Some of the smaller townships in the district commemorate the exploits of Australian troops in such names as Pozieres, Amiens, Bullecourt and Fleurbaix.

Climate.

The Granite Belt forms part of a plateau which is 2,500 to 3,500 feet above sea level. The climate, as indicated by Table 1, is therefore mainly temperate. The range of temperature varies considerably between summer and winter. High maximum readings between 90 deg. and 95 deg. F. are recorded during the summer, though the nights are invariably cool. Severe frosts occur during the winter months with grass readings as low as 5 deg. F. Snow is, however, a rare phenomenon.

TABLE 1.

CLIMATIC DATA—STANTHORPE.

—	January	February	March	April	May	June	July	August	September	October	November	December	Year
Mean Maximum Temperature in ° F. ..	81·1	79·6	76·0	72·6	64·3	58·7	57·3	60·8	66·8	73·5	78·4	80·9	70·8
Mean Minimum Temperature in ° F	59·0	59·1	55·6	50·4	40·7	36·6	33·2	35·0	40·9	47·8	53·4	56·8	47·4
Average Rainfall in Points .	359	328	270	172	185	196	203	182	228	255	269	351	2,998

The Granite Belt has an average annual rainfall of 30 inches, most of which falls during the summer and in that season can be regarded as fairly reliable. Winter and early spring rains are very variable. However, there is usually ample soil moisture during this period because of the mildness of the weather and the low rate of evaporation. A knowledge of local conditions is a great help to the farmer in planning the year's programme, particularly when vegetable crops provide the major part of the farm income.

Soils.

As is suggested by the name Granite Belt, the soils of the district are derived from granitic rock. The slow process of disintegration of granite boulders over the ages is reflected in a range of soil types. Some soils are coarse, sandy loams of considerable depth where they occur in hillside pockets and valleys. Others are of a much finer texture and of variable depth, overlying a stiff impermeable clay subsoil. The deeper soils are, of course, the most suitable for horticultural purposes.

Soils of the granitic type erode very easily during periods of heavy rain, and loss of top soil has certainly lowered the productivity of many farms. Protective measures and, in some cases, remedial measures should, therefore, be an essential feature of soil management practices. Contour planting for both annual and perennial crops is desirable, but even this must be supplemented by the systematic planting of green manure cover crops. The most generally used cover crop is New Zealand blue lupin, which, when planted in late February or March, makes good growth at a time of the year when the soil moisture is adequate. The

crop is either ploughed into the ground or disced and left on the surface as a "blanket" mulch, the latter method being preferable. Summer green manures which would be planted in October are seldom used, for at this time of the year competition for soil moisture might adversely affect the trees. Weed growth is, however, allowed to form a ground cover when the summer rains have begun.

Timbers.

Cypress pine, stringy bark, messmate, yellow box, cabbage gum and wild apple are among the most common of the natural timbers. A wide range of wattles is also to be found in the district; the bark of one variety (black wattle) finds a ready market for tanning purposes. About 1,200 acres of land, most of which is unsuitable for horticultural purposes, have been planted to exotic pines.

Horticultural Uses.

Temperate fruits and a number of vegetables are grown extensively in the Granite Belt (Table 2). Of the several fruits, apples, grapes, pears, plums, peaches and apricots are the most important. Stone fruits are grown throughout the district (Plate 26) but vineyards are mainly established in the south and apple (Plate 27) and pear orchards at the northern end. How far this aggregation can be attributed to the suitability of the soils and climate for the crops concerned is a debatable point. Excellent quality fruit can be grown and pest and disease control measures are adequate for requirements. The main hazards are hail and frost. Late spring frosts are not uncommon and they may occur after the trees or vines have commenced to make new season's growth. Heavy losses have been recorded from time to time, as in the season 1948-49.

Plate 26.
A TEN-YEAR-OLD PEACH ORCHARD AT BROADWATER.

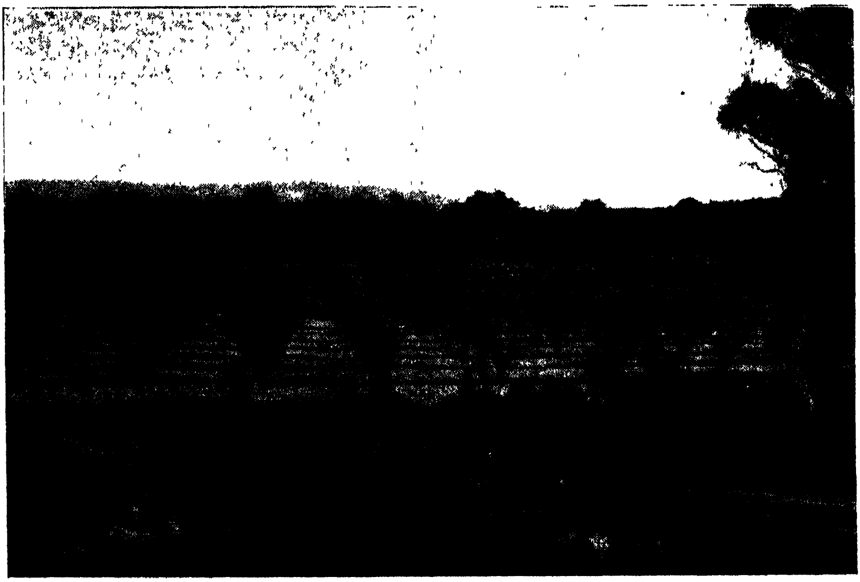


Plate 27.
AN APPLE ORCHARD AT APPLETHORPE.

TABLE 2.

GRANITE BELT PRODUCTION DATA (1948).

Crop.	Production.	Acreage under Crop.		
		Bearing.	Non-Bearing.	Total.
Apples	455,254 bushels	4,911	1,097	6,008
Pears	38,498	301	118	419
Plums	67,353	886	355	1,241
Peaches	83,961	1,105	358	1,463
Apricots	22,386	250	117	367
Grapes	5,576,645 pounds	1,830	273	2,103
Tomatoes	270,874 ½-bushels	..	..	1,460
Beans	90,986 bushels	..	..	1,079
Cabbages and Cauliflowers ..	58,074 dozen	..	..	528

Growers with less than 10 acres cropping 112
Growers with more than 10 acres cropping 623

The principal vegetables grown in the district are tomatoes, beans and the two common crucifers, cabbages (Plate 28) and cauliflowers. Under sub-tropical conditions, all of these are normally grown during the autumn and winter months. The more temperate climate of the Granite Belt favours their production during the summer, when Queensland and some southern markets are under-supplied. The relatively dry climate tends to check the development of fungus diseases, which are apt to be a trouble in other parts of the State. If the rainfall is adequate, excellent crops of high quality produce are grown.

Few farmers are in a position to irrigate—surface water is sparsely distributed over the district, while underground supplies are limited and often unsuitable for the purpose. Vegetable crops are, therefore, somewhat speculative, for dry weather during the early stages of growth may give crops a setback.

Plate 28.
A CABBAGE CROP IN THE STANTHORPE DISTRICT.

The more important varieties of fruit and vegetables grown in the district are:—

Apples—Lord Nelson, Granny Smith, Jonathan, Delicious, McIntosh Red, Stayman's Winesap and Gravenstein.

Pears—Williams' Bon Chretien, Packham's Triumph and Clapp's Favourite.

Peaches—Wiggins, Blackburn Elberta, Mayflower, J. H. Hale, Dripstone Elberta and Golden Queen.

Japanese Plums—Wilson, Santa Rosa, Burbank, Doris, Narrabeen and October Purple.

English Plums—Pond's Seedling, Grand Duke, Angelina Burdett and President.

Grapes—Chaouch, Muscat Hamburg, Gros Colman, Waltham Cross and Purple Cornichon.

Tomatoes—Sioux, Grosse Lisse, Valiant and Rutgers.

French Beans—Brown Beauty.

Cabbage—Succession.

Cauliflowers—Early Phenomenal.

Almost all the fruit and vegetables are sold on the fresh produce market. Very little of the produce is canned, dried or processed. The main market outlets are in Queensland and New South Wales, and the

bulk of the produce passes through the metropolitan markets at Brisbane and Sydney respectively. Limited cold storage facilities are available in the district. These are used mainly for apples but they also serve a useful purpose in pre-cooling fruit and vegetables for subsequent transit in iced railway wagons to North Queensland.

Size of Holdings.

The size of the farm unit varies with the type of country available. Where the topography is easy and the soil relatively fertile, properties may not exceed 25 acres and settlement is comparatively close. Frequently, however, horticultural soils are situated as pockets in the middle of inferior soils of little value and many holdings are consequently more than 20 acres in extent.

The Future.

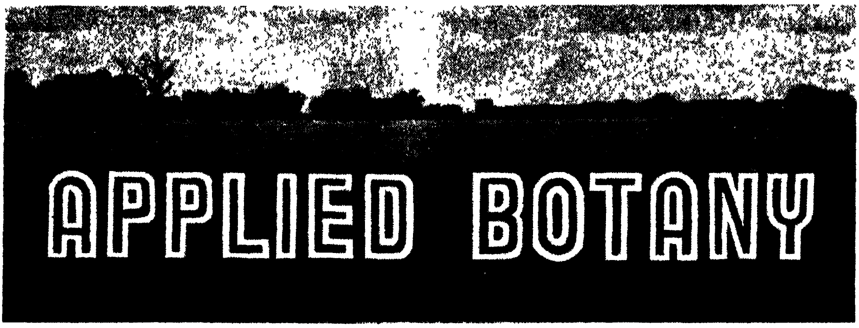
Fruit and vegetable growers in the Granite Belt have had good and bad times but the district has, nevertheless, made steady progress. It can scarcely be displaced from its present unique position in the horticultural economy of the State. Progress has been developed along sound lines, particularly in the past 10 to 12 years when many varieties of trees and vines have been grafted to more popular and profitable types. Careful consideration has been given to the selection of suitable varieties for the planting of fresh areas, and growers generally are becoming more conscious of their obligations regarding soil improvement and maintenance as well as pest and disease control.

The annual export of approximately 50,000 cases of apples helps considerably in relieving the local markets. The work done in the transportation of perishable fruit and vegetables to the far north of the State by ice-cooled railway wagons has proved satisfactory, and when put into more general use should help considerably in the distribution of much of the district's produce to the outlying areas of Queensland. There is still ample room for an expansion of the area under crop as well as the more efficient use of existing cultivated areas. The Granite Belt must, therefore, grow in importance to meet the demand which an increasing State population will inevitably create for its produce.

Junior Farmer Club Notes.

New clubs have recently been formed at Goombi and Burncluith, in the Chinchilla district. Goombi officers are Ben. R. Walsh (Club leader), John Ridge (deputy-leader), and Noel Fisher (secretary-treasurer). Burncluith's Club leader is Ray Roberts; N. Stark is deputy-leader, and Leslie H. Wolski secretary-treasurer.

The following members have been selected for the Junior Farmers' Camp at the forthcoming Brisbane Show:—Marshall Muller (Allora), John J. Coombes (Bauple), Charles W. Hill (Biloela), Allan Harm (Cloyna), Colin Wedemeyer (Gayndah), Ben. R. Walsh (Goombi), Donald M. Cunningham (Goomboorian), Vincent E. Walker (Mondure), Claude Scheiwe (Murgon), Noel Dreger (Mount Murchison), William F. Rowe (Thangool), Colin Mansfield (Tiaro), Norman Munckton (Theodore), Douglas K. Madsen (Warwick), and Edgar B. Horne (Wondai).



Star Thistle—A New Weed Pest.

C. T. WHITE, Government Botanist.

A WEED that may possibly develop into a serious pest of agricultural areas appeared in 1948 in the Fassifern Valley in south-eastern Queensland. The plant is a native of southern and western Europe and is well established as a common and aggressive weed in the southern States of Australia.

Description.

Star Thistle (Plate 29) is a biennial or perennial intricately branched spreading weed, two to three feet tall, and inclined to become somewhat woody when old. The leaves are dull green, almost two inches long, and deeply lobed to the midrib. The flowers are lilac or pale purple and are borne in the centre of a mass of spiny, rigid, pale straw-coloured bracts. The seeds are one-eighth of an inch long, pale gray or straw-coloured streaked with brown.

Botanical and Common Name.

The plant is known botanically as *Centaurea calcitrapa*. Star thistle is the standardised common name. Other thistles occurring in Queensland have been called star thistle, but they differ from this pest in having yellow flowers and in being annuals.

Control.

So far as is known, the weed occurs in Queensland only in isolated patches, and hand-pulling or cutting off several inches below the soil surface is probably the most effective means of eradication. Experience in the southern States suggests that hormone-type weedkillers may be of use against infestations that cannot be dealt with by normal methods.

Plate 29.

Star Thistle.—Flowers lilac or pale purple: leaves dull green.

PLANT PROTECTION

Tomato Diseases and Their Control.

J. E. C. ABERDEEN (Formerly Pathologist, Science Branch).

(Continued from page 25 of the July issue.)

DISTRICT NOTES ON DISEASE INCIDENCE.

THERE are four main tomato growing areas in Queensland. Commencing from the north they are (1) Bowen, including the Burdekin delta to the north (2) Rockhampton, and south to Yarwun, (3) Brisbane (Metropolitan) and the Redlands area immediately south of Brisbane, and (4) Stanthorpe. The fifth area discussed in these notes, Innisfail, supplies a small local market and is included because of striking climatic and pathological differences rather than for its economic importance.

The range of disease and insect problems is very similar in each district but there is a distinct difference in the relative importance of the various diseases. Certain general principles govern the factors responsible for this variability.

Once a disease is present in a district, no matter to how small an extent, the two most important factors in its subsequent spread are temperature and moisture conditions. Figures 1 to 5 summarise the data on these two factors for each district. As regards temperature, the mean maximum and the mean minimum for each month have been graphed. For moisture conditions both relative humidity and rainfall have been included but the former is usually the more important in determining plant disease incidence. The growing season for tomatoes in each district is also indicated.

The relationship of the various diseases to temperature and moisture conditions is shown in Table 1. The grouping here is necessarily approximate but demonstrates the conditions necessary to initiate an epidemic. The disease once initiated may sometimes carry on into a season normally unfavourable. On the basis of this grouping lines have been drawn across the temperature graphs in the figures at 75 deg. F. and 60 deg. F. As a general guide to the influence of temperature on the incidence of the various diseases in the different districts it may be said that:—

(1) So long as the mean maximum temperatures are above 75 deg. F., those diseases favoured by high temperatures—for example, Fusarium wilt—must be regarded as possible dangers, the likelihood increasing as the mean maximum exceeds 75 deg. F.

(2) The one disease listed as being favoured by low temperatures (Irish blight) is very unlikely to occur when average minimum temperatures are greater than 60 deg. F. The farther

the minimum is below this figure, the greater the possibility. This standard is based principally on the incidence of the disease in the Brisbane-Redlands district.

(3) The third group of diseases, falling into the 60 deg.-75 deg. F. range, cannot be delimited quite as sharply as the previous two.

TABLE 1.

CLASSIFICATION OF DISEASES BY THEIR TEMPERATURE AND MOISTURE RELATIONSHIPS.

Temperature.	Moisture Relationships.			
	Favoured by Dry Conditions.	Independent of Rainfall.	Favoured by Intermittent Showers and High Humidity.	Favoured by Continuous Rain or High Humidity.
High temperatures. Mean higher than 75° F.	Blossom end rot	Fusarium wilt Bacterial wilt		Leaf mould
Moderate temperatures. Mean 60–75° F.	Big bud ..	Verticillium wilt Spotted wilt	Target spot Septoria spot Bacterial spot Bacterial canker	Leaf mould Target spot Septoria spot Bacterial spot Bacterial canker
Low temperatures. Mean less than 60° F.				Irish Blight

Bowen Area.

Tomato growing in the Bowen area is confined to the autumn, winter and early spring months. The plants are set into the field during the period March to May and the fruit comes on to the market in the months of June, July, and August. In the last few years this marketing period has been extended to September and early October by later plantings than above. From Figure 1 it will be seen that the growing period is characterised by low rainfall and low relative humidities. These conditions restrict the development of leaf diseases such as Irish blight, bacterial canker, bacterial spot, septoria leaf spot and target spot. Occurrence of the last-mentioned, however, is sufficiently likely to justify the use of copper in the dusts and sprays. The only outbreak of Irish blight in this area was a particularly severe one in 1927. In this case the rainfall for the months of June and July was 4·46 inches and 2·49 inches, respectively. The average for these months is 1·64 and 0·91 inches respectively.

Fusarium wilt and yellow mosaic are definitely of major importance. The local strains of tomato, generally known as Bowen Buckeye, are all very similar, and possess a high degree of resistance to Fusarium wilt. This variety has several marketing disadvantages and its replacement by better ones is desirable, but wilt resistance will need to be a major consideration in any trials carried out.

FIG 1
Bowen

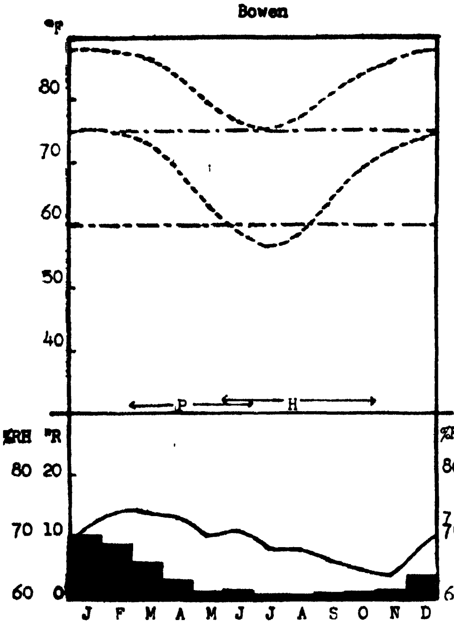


FIG. 2
Rockhampton

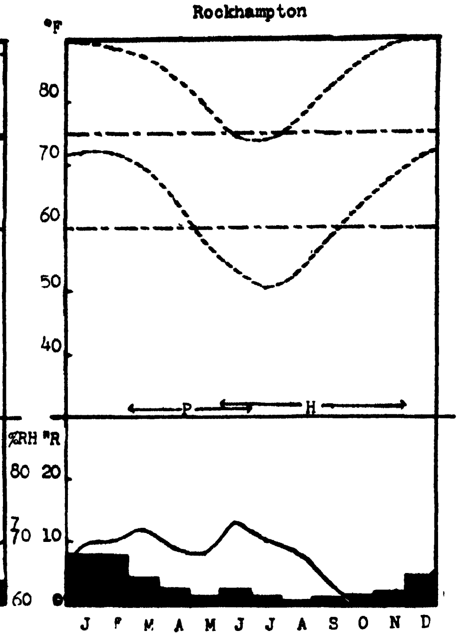


FIG. 3
Brisbane

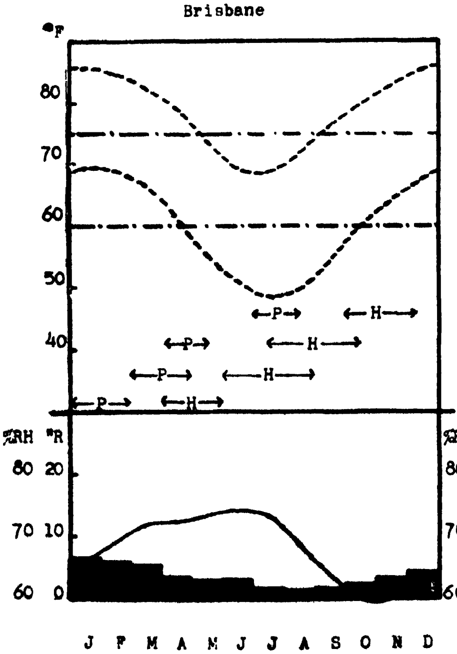
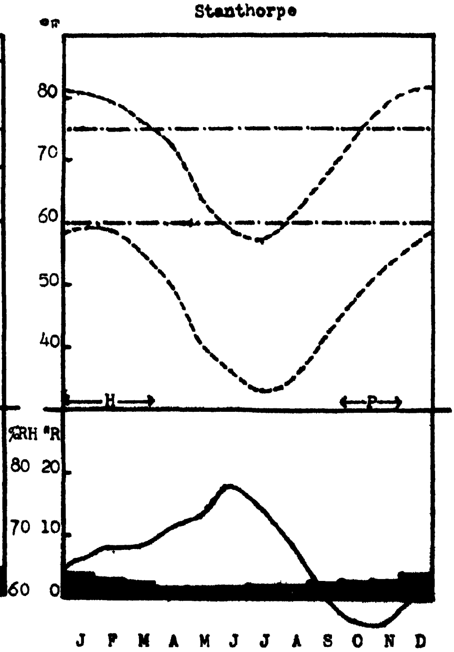


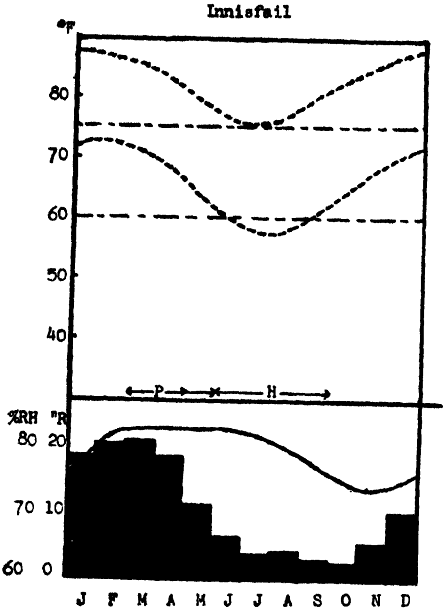
FIG. 4
Stanthorpe



For explanation of figures, see opposite page.

FIG. 5

Innisfail



Explanation of Figures 1-5.

°F (shown as dotted line)=mean maximum and mean minimum temperatures.

%RH (shown as unbroken line)=percentage relative humidity.

"R (shown blocked in black)=inches of rainfall.

P=period of planting seedlings into field.

H=period of harvesting.

Yellow mosaic is a difficult problem and control measures are all preventive ones. Though it is not proven by transmission tests there is little doubt that several of the common Solanaceous weeds are carriers. Big bud is commonly present but does not constitute a major problem.

To sum up the Bowen position, it may be said that insect pests (corn ear worm, jassids, and thrips) and mites cause the greatest loss in the local wilt-resistant variety at present grown, and the main emphasis in the sprays and dusts applied must be on the insecticide, a fungicide being added at the discretion of the grower or as advised.

Rockhampton-Yarwun.

The period over which tomatoes are grown in the Yarwun-Rockhampton area is a little longer than for Bowen, the fruit being marketed somewhat later, until the end of October.

Conditions here are a little more favourable to fungal and bacterial leaf diseases. Irish blight occurs very spasmodically, epidemics being very rare. Target spot is a constant trouble throughout and may be severe if the rainfall is above average. Fusarium wilt is present and the effect of the cooler winter temperature is still insufficiently low to justify planting of susceptible varieties. Those areas without irrigation suffer heavy losses from blossom end rot if the winter and spring rains are at all under average.

While more emphasis must be placed on fungicides than for Bowen, insect pests and tomato mites are probably still the major causes of losses. The regular use of a treatment combining insecticide and fungicide is recommended.

Brisbane-Redlands Area.

The Brisbane-Redlands area has the longest tomato-growing season of the four districts. Plantings into the field are made from January to July and fruit harvested in varying quantities from April to early December. There is some variation in the problems encountered, however, and for convenience of discussion this period will be divided into four—namely, autumn, winter, early spring, and spring crops. The descriptive term in each case indicates the period of the year that the crop comes on to the market, and has a fairly uniform interpretation among growers. The autumn and winter crops merge into each other, as might be expected, but the early spring and spring crops are fairly well delimited, as will be indicated in discussing their associated problems below.

Varieties used for planting out into the field in January and February must combine two qualifications—the maximum amount of resistance to Fusarium wilt and a good foliage cover for the fruit to prevent sunscald. Bacterial wilt also attacks this crop in many areas around Brisbane. While hardly affecting the tomato crop as a whole, this latter disease may entail complete loss to an individual grower. Bacterial spot is also prevalent in this crop following continued rains. Target spot is usually present and may also become prevalent, depending on rains. Irish blight may attack the tail end of this planting but is relatively rare. This autumn crop is a difficult one to grow in many districts but is economically worth while as the fruit comes on to the market as the Stanthorpe crop tails off.

If planting in March and April, the risk from Fusarium wilt is considerably reduced and varieties intermediate in resistance, such as Sioux, Salad's Special and Sunnybrook Earliana may be used. The light foliaged varieties such as Break o' Day may be planted with little fear of sunscald. Target spot and bacterial spot may still cause trouble but with the reduced rains this is less likely. Irish blight is still relatively rare, being controlled by reduced rainfall, though temperatures are often favourable.

While there is no sharp dividing line between the varieties used for the previous two plantings, the early spring crop requires varieties that are specialised in their ability to set fruit more freely during the cold weather of July and early August. Such varieties are mainly the small fruited cluster types, such as Salad's Special and Potentate, and a few of the Chinese types—for example, Rouge de Marmande. These are transplanted into the field during April. The disease situation is very similar to that described for the winter crop with the additional possibility of Verticillium wilt. Also, as the cluster varieties must be pruned and trellised to produce reasonably sized fruit, there is greater possibility of bacterial canker and mosaic being spread if originally present.

The main spring crop swings back to those varieties favoured for the winter crop and the seedlings are planted into the field during July. Except for differences brought about by the gradually rising temperatures, the disease problems are very similar. Fusarium wilt presents one important difference. Whereas varieties possessing little resistance may be successful in the winter crop, the main spring crop must be planted to one of the most resistant varieties. With the season advancing into the warm weather when the main crop is developing,

susceptible varieties will mature only the early hands before being overcome by wilt. Pruning and trellising are also practised for this spring crop in the Redlands district and this again adds to the risk of spreading bacterial canker and mosaic if these diseases are present.

It has been seen that leaf and fruit diseases are constantly present throughout these crops. Consequently the emphasis in the sprays and dusts must be placed on the fungicide. Also it is advisable to always include sulphur, as the tomato mite is widespread and its damage not recognised by many growers until too late. Insecticides will be required in the warmer parts of the year and particularly in the spring.

Stanthorpe Area.

In contrast to the three previous areas the Stanthorpe crop is a summer one, the young plants going into the field in October and November. It will be seen from Figure 4 that the relative humidity is very low for the early part of the season, with a consequent inhibition of the common bacterial and fungal leaf and stem diseases. However, target spot and Septoria leaf spot may cause considerable trouble during the latter half of the season and necessitate thorough treatment with a copper fungicide. Irish blight is rare and the few records available are for the month of April. Fusarium wilt is present but is relatively mild in its effect on the plant. Big bud occasionally infects a considerable proportion of the plants on individual farms.

The use of fungicides in this area is most important in the latter half of the crop. It may also be advisable occasionally to apply an insecticide both at this time and in the early part of the crop.

Innisfail Area.

The characteristic of this district is the very high rainfall and uniformly high humidity from March to July. Target spot is present and a source of loss but the most interesting feature is the epidemic development of leaf mould, which becomes a major problem. While this disease has been recorded in southern Queensland and on the Atherton Tableland, it is usually only on isolated plants in very protected positions. In other States it is only serious in glasshouses.

The combined insecticide and fungicide will be necessary in this area as the warmer climate is favourable to insect activity and the high rainfall conducive to the spread of fungal diseases.

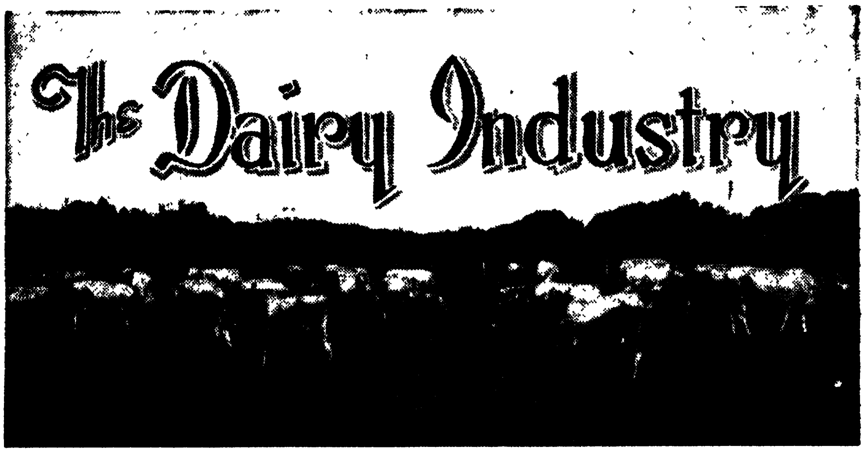
[TO BE CONTINUED.]

SEEDS AND CUTTINGS OF PASTURE PLANTS.

The Department of Agriculture and Stock often receives enquiries regarding supplies of cuttings of grasses such as Kikuyu, elephant and Para (also known as panicum muticum or giant couch).

Seeds of various grasses and pasture legumes which are usually in short supply are also frequently sought. These seeds include green panic and other Guinea grasses, blue panic, buffel grass, and the so-called "Townsville lucerne."

Farmers and others handling such planting material are requested to inform the Department so that enquiries can be directed to any local sources of supply. Seeds offered for sale must, however, comply with certain conditions, particulars of which are obtainable on application.



The Determination of Water in Butter.

Prepared in the Division of Dairying.

THE method used for the determination of water in butter—commonly known as the moisture test—may be summarised as follows:—

> A known weight of butter in a weighed metal dish is heated until all water is expelled as steam. The dish and its contents are then cooled to atmospheric temperature and again weighed. The loss in weight is the water in the particular weight of butter taken and the percentage may be calculated by simple proportion.

There are quite a number of modifications in technique, mainly due to various types of balances, but the principles of the test remain the same.

The equipment required is—

1. Balance and necessary weights.
2. Metal cup.
3. Spatulas to transfer butter to the cup.
4. Heater.
5. Tongs for handling the hot cup.
6. Cooling bath.
7. A number of clean dry cloths.

Facilities and Precautions.

A balance sensitive to at least 0·01 ($\frac{1}{100}$) gram is necessary for accurate moisture tests. It is an instrument of precision and should be treated as such. It must not be placed in a position exposed to air currents, as accurate tests would be impossible under those conditions. Splashing water, steam, heat radiations and poor lighting are other factors which must be guarded against.

SMALL LABORATORY FOR A BUTTER FACTORY.

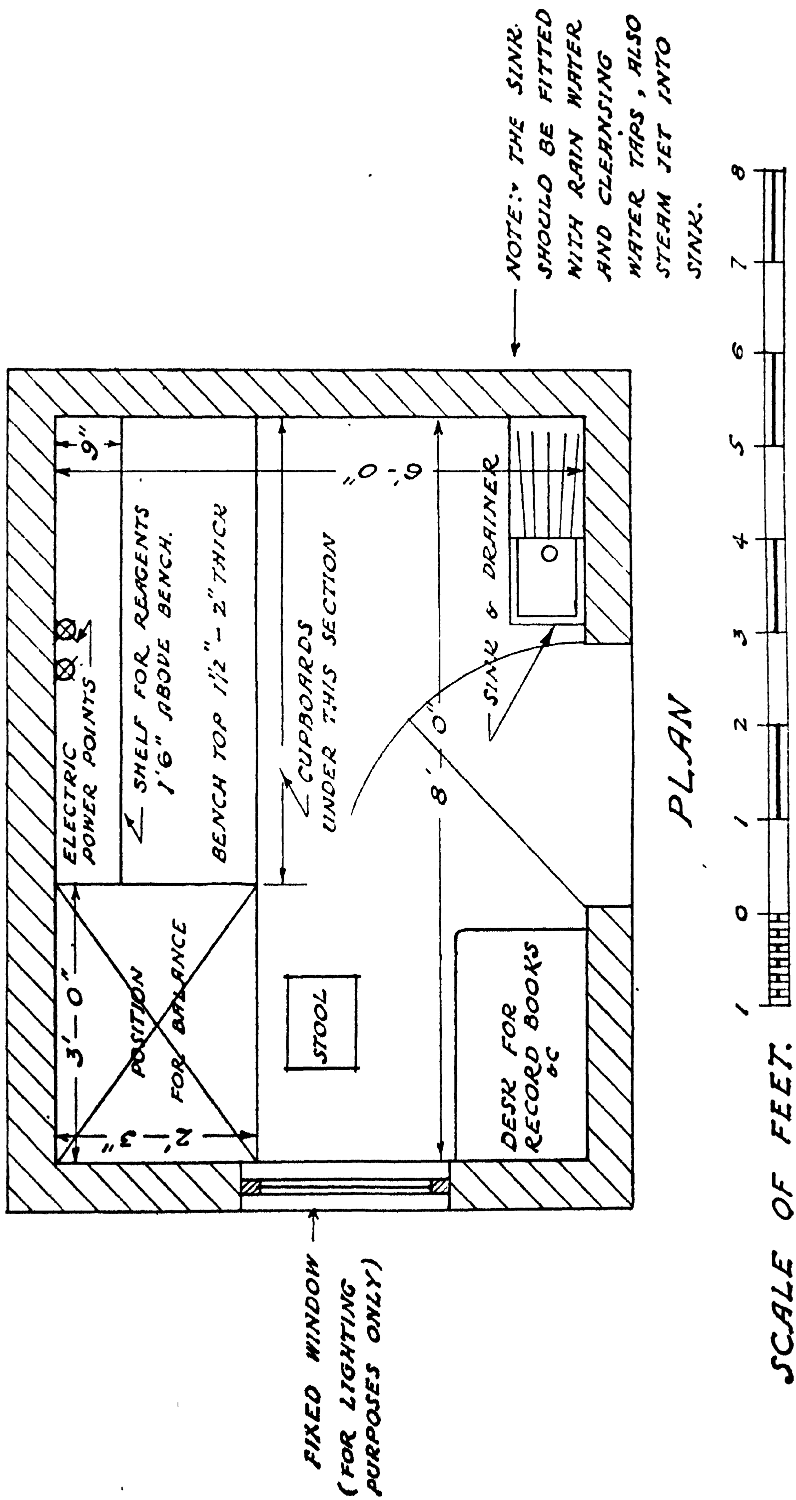


Plate 30.

The bench or shelf on which the balance stands must be level and absolutely rigid so that vibrations from machinery, &c., do not interfere with the balance. So important are accurate moisture tests that a small laboratory or test room should be built as an integral part of every butter factory in which real efficiency is desired. This room, which for chemical tests need be only about 8 ft. by 6 ft., must be quite distinct from the room in which the fat tests are performed and close to the churning room. The size suggested offers ample bench space for moisture, salt and acidity tests which the butter-maker may desire to perform from time to time. A plan of such a laboratory is shown in Plate 30. Even in a room such as this, the balance should be protected from dust and chance currents of air by a case, preferably with a sliding glass door at the front.

The type of heater used in most factories is a spirit lamp. This certainly serves the purpose, but it has the great disadvantage that the bottom of the cup becomes covered with a deposit of carbon and the weight of the cup is thereby altered. As most factories generate electricity, the spirit lamps in such cases should be replaced by a suitable electric heater, which is clean and equally rapid. Suitable types are shown in Plate 31. The adapted electric radiator has a heating element of about 500 watts and the hot plate is of the three-heat type. Spare heating elements should be kept on hand for emergencies and only require to be screwed into place. Whatever type of heater is used, it should be placed *outside* the balance case and at least 1 foot away.

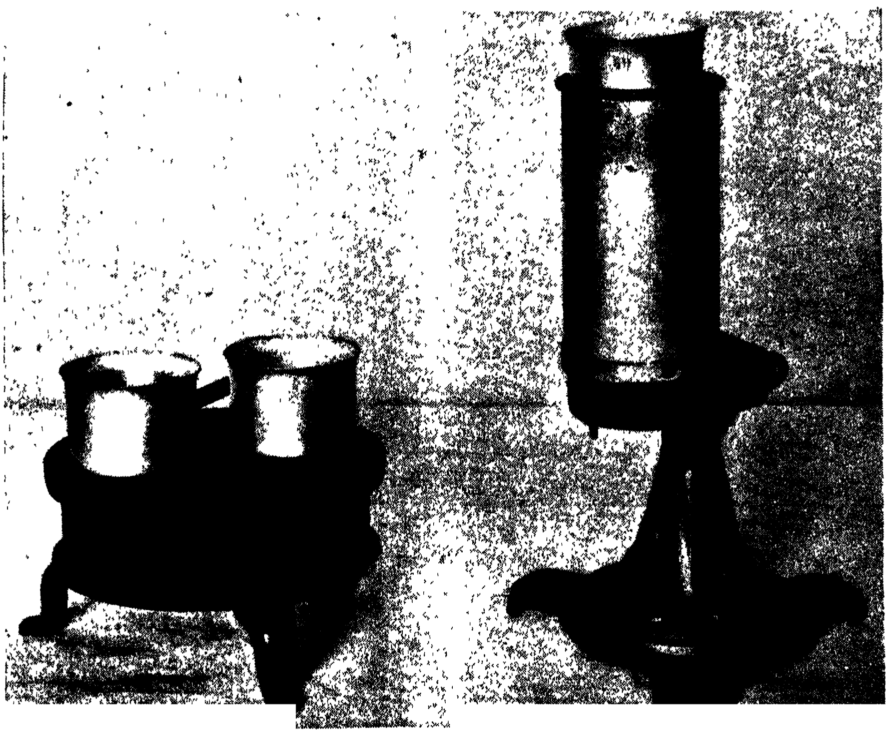


Plate 31.

ELECTRIC HEATERS.—Left—Three-heat hot plate. Right—Adapted electric radiator.

Another important piece of equipment is a cooling bath in which the hot dish may be rapidly cooled to atmospheric temperature. A dish of cold water is very satisfactory for this purpose. A supply of clean, dry cloths must be available, as the dish must be wiped perfectly dry before being placed on the balance. *The dish must never be placed on the balance whilst hot,* as the heat transferred to one side of the balance immediately puts the balance out of adjustment and an inaccurate weighing or reading results, which may be perpetuated in following tests. The practice of making "hot weighings" is probably the principal cause of inaccurate factory tests.

Weights should never be handled with the fingers, but always with a small pair of forceps. The balance should always be brought to rest before adding weights or altering their position, as rough treatment will quickly wear away the sharp knife edges of the balance and destroy its sensitivity.

The remainder of the equipment requires little discussion. The metal cup is usually of aluminium, which is quite suitable for the purpose. Spatulas for the addition of butter to the dish should be of bone or some non-scratching material. One spatula should be ground to a fine point to facilitate the final adjustment. Tongs for handling the hot cup may be of either the ordinary hand type or the spring type.

Taking the Sample.

In all chemical work the most important part of the process is the taking of the sample. One of the first axioms of the analyst is "*An analysis is only as accurate as the sample,*" and a sample must therefore be as representative of the whole as is possible. Butter from one end of the churn has not necessarily the same composition as butter from the centre or the other end, and *at least three portions of butter from various positions in the churn must be taken* to obtain a representative sample. In taking these portions the exposed surface of the butter, with its adhering free moisture, must be removed before the portion is taken by using a spatula or trier.

Having obtained a representative sample this must be mixed thoroughly so that the analysis may be carried out in duplicate, if required, with the same result. There are several ways of preparing the sample, the main methods being—

(*a*) Place the butter in a dry glass jar with a tight-fitting lid, and place the jar in warm water at a temperature of about 100 degrees Fahr. until it is thoroughly softened and may be mixed, by shaking, into a homogeneous creamy mass. If this method is used care should be taken to see that no unmelted lumps of butter remain. It is equally important not to overheat the sample, as this causes a separation of the serum from the fat, and in this condition it is almost impossible to obtain a representative sample.

(*b*) Place the portions of butter on a slab of glass, or a glazed tile, about 6 to 8 inches square, and quickly and thoroughly mix with a bone spatula. A wide-mouthed cup of china or metal will be equally serviceable, but a narrow-mouthed vessel should be avoided, as it is difficult to mix the sample in a vessel of this type.

For factory use the latter method is recommended, as it is much quicker and the very small amount of moisture lost by evaporation during the mixing is not sufficient to cause a noticeable error.

The weighing of the ten grams of butter should be carried out immediately after the sample is prepared. If it is not convenient to weigh immediately, the sample should be placed in a glass jar with a tight-fitting lid and mixed just prior to weighing.

Correct Method of Weighing.

With all balances, except the Avery balance, the weighing should be performed by allowing the balance to swing freely and noting the number of divisions reached by the pointer on each side of the centre line of the scale. When the balance is in equilibrium the pointer swings the same number of divisions on each side. *Do not accept a weighing in which the pointer remains stationary,* as the beam or pointer may be stuck.

The various techniques to be followed when using the better known types of balance are given in the following sections.

The Physical Balance.

The physical balance is one which can be used for many other purposes than the determination of water in butter. It can be used for general analytical purposes where extreme accuracy is not required, because a good physical balance may be sensitive to 0·001 ($\frac{1}{1000}$) gram. The balance shown in Plate 32 is the cheapest type, and requires a set of weights down to 0·01 gram.

Two methods may be used with this type of balance—

1. (*a*) See that the pointer swings an equal number of scale divisions on each side of the centre line with the pans empty.

   (*b*) Weigh the clean dry cup as accurately as possible by placing the cup on the left pan and the weights on the right pan.

   (*c*) Add ten grams to the weights already on the right pan and record the total weight (A).

   (*d*) Place butter from the well mixed sample into the cup until the balance is again in equilibrium.

   (*e*) Place the cup over the heater and shake gently during the evaporation of the water to prevent spurting. During the final stage, the butter froths up in the cup, then subsides, and the fat may be seen boiling quietly. The colour will then be a light brown.

   (*f*) Remove the cup from the heater and cool to atmospheric temperature in the cooling bath.

   (*g*) Wipe the outside of the dish perfectly dry and replace on the left pan of the balance.

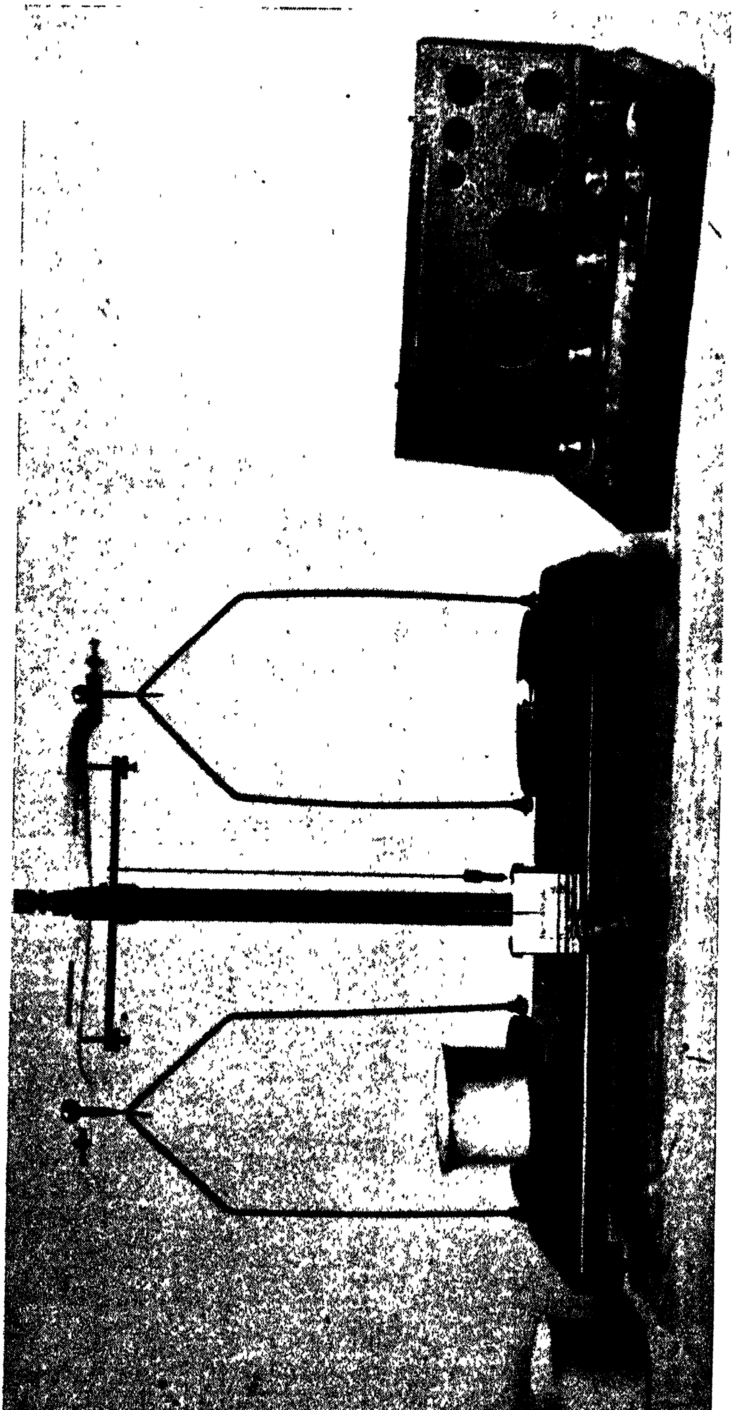


Plate 32.
The physical balance with set of weights and metal cups.

(*h*) Weigh again as accurately as possible and record the weight (B). Subtract the second weight (B) from the first weight (A). The difference is the weight of water in the ten grams of butter taken.

$$\text{Percentage of water} = (A-B) \times \tfrac{100}{10} = (A-B) \times 10$$

Example—

1st weight (A)	=	38·54 grams
2nd weight (B)	=	37·02 grams
Difference (A—B)	=	1·52 grams
Percentage of water	=	1·52 × 10
	=	15·2

2. The second method eliminates the use of a number of weights, the determination being performed by the use of a 10 gram, a 1 gram and the eight fractional weights from 0.5 down to 0.01 gram. Prepare a counterpoise from a piece of lead, brass, or copper to weigh exactly the same as the clean dry cup. If there are two or more cups available, a counterpoise for each may be made so that a number of tests may be performed at the same time. Then proceed as follows:—

(*a*) See that the pointer swings an even number of scale divisions on either side of the centre line with the pans empty.

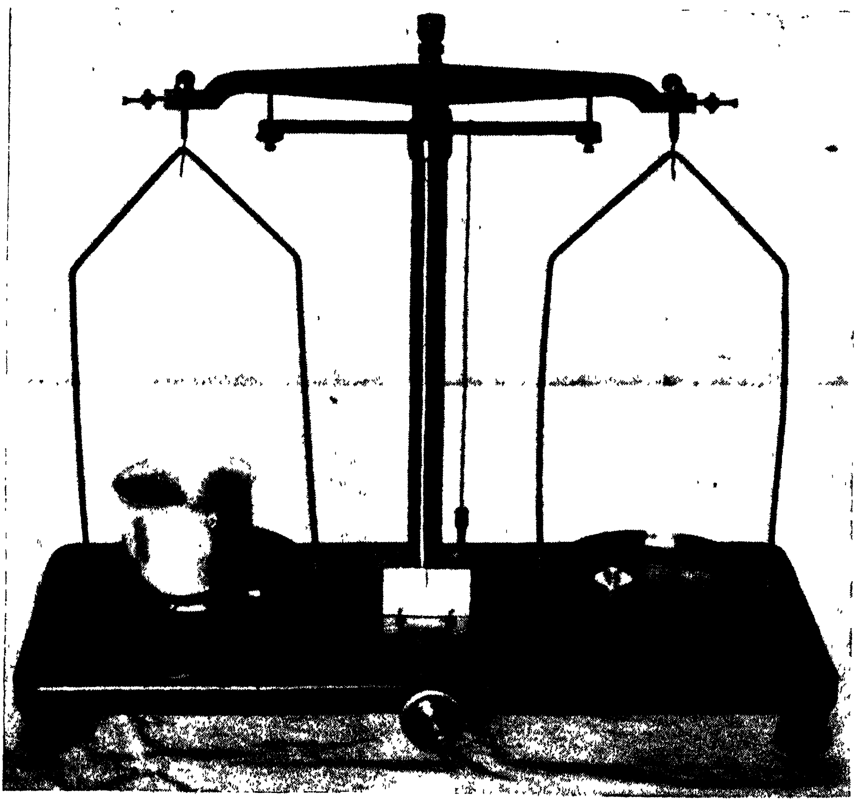


Plate 33.

The physical balance with cup, counterpoise and weights in position. The sum of the weights on the left pan is 1.57 grams, indicating 15.7 per cent. of water.

(*b*) Place the clean dry cup on the left pan and the corresponding counterpoise on the right pan and see that the balance swings evenly. If not, adjust the counterpoise to the correct weight.

(*c*) Place a 10 gram weight on the right pan with the counterpoise.

(*d*) Place butter from the well-mixed sample into the cup until the balance is again in equilibrium.

(*e*) Place the cup on the heater and shake gently during the evaporation of the water to prevent spurting. During the final stage the butter froths up in the cup, then subsides, and the fat may be seen boiling quietly. The colour will then be a light brown.

(*f*) Remove the cup from the heater and cool to atmospheric temperature in the cooling bath.

(*g*) Wipe the outside of the cup perfectly dry and replace on the left pan of the balance.

(*h*) Leave the 10 gram weight on the right pan and add small weights to the *left* pan until the balance is again in equilibrium. The sum of the small weights added (C) is the weight of the water which was evaporated from the 10 grams of butter.

Plate 33 shows the balance with the cup, counterpoise, and weights in place.

$$\text{Percentage of water} = C \times \tfrac{100}{10}$$
$$= C \times 10$$

Example.—1·57 grams were added to the left pan.

$$\text{Percentage of water} = 1{\cdot}57 \times 10$$
$$= 15{\cdot}7$$

Physical Balance with Attached Rider.

A more satisfactory type of physical balance is that shown in Plates 34 and 35. A rider attached to the beam of this balance eliminates the use of weights smaller than 1 gram. This balance is adjusted with the rider on the O mark on the extreme left of the beam. The techniques of the two methods given above require a little modification when using this balance.

1. (*a*) See that the pointer swings an even number of scale divisions on each side of the centre line with the pans empty and the rider on the 0 mark of the beam.

(*b*) Weigh the clean dry cup by placing the cup on the left pan and weights down to 1 gram on the right pan until an extra 1 gram makes the weight too heavy. Then slide the rider along the beam until equilibrium is attained.

Example.—If the cup weighs 28·28 grams, 28 grams would be placed on the right pan (29 grams would be too heavy) and the rider slid along the beam to the 0·28 mark showing a total of 28·28 grams. (See Plate 34.)

(*c*) Leaving the rider in the same position, add 10 grams to the weights on the right pan and record the total weight (A).

Example.—28·28 + 10 = 38·28 (A).

(*d*) Place butter from the well mixed sample into the cup until the balance is again in equilibrium.

(*e*) Place the cup on the heater and shake gently during the evaporation of the water to prevent spurting. During the final stage the butter froths up in the cup, then subsides, and the fat may be seen boiling quietly. The colour will then be a light brown.

(*f*) Remove the cup from the heater and cool to atmospheric temperature in the cooling bath.

(*g*) Wipe the outside of the cup perfectly dry and replace on the left pan of the balance.

(*h*) Weigh again as described in (*b*) above, and record the weight (B). Subtract the second weight (B) from the first weight (A). The difference is the weight of water in the 10 grams of butter and the percentage is obtained by multiplying the difference in weight by 10.

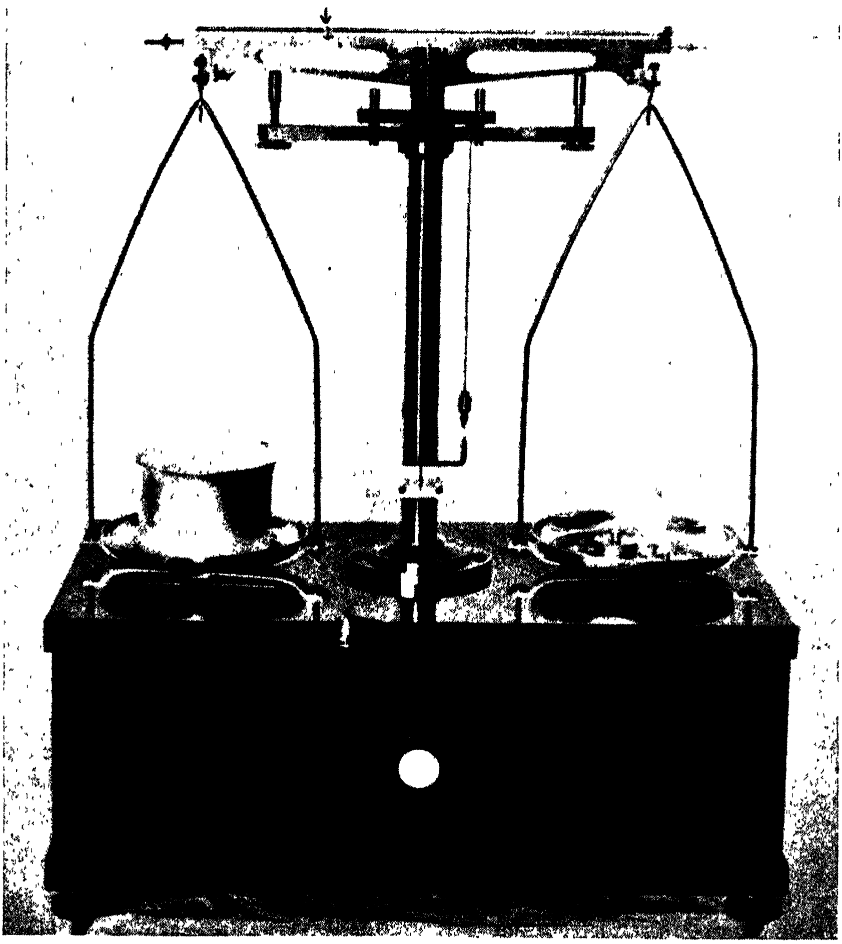


Plate 34.

The physical balance with attached rider showing a weight of 28.28 grams. Note that weights smaller than 1 gram are not required. The rider is indicated by an arrow.

Example.—

1st weight (A)	=	38·28 grams.
2nd weight (B)	=	36·72 grams.
Difference (A—B) ..	=	1·56 grams.
Percentage of water ..	=	1·56 × 10.
	=	15·6

2. Prepare a counterpoise for the cup as described previously.

(*a*) See that the pointer swings an even number of scale divisions on each side of the centre line with the pans empty and the rider on the 0 mark of the beam.

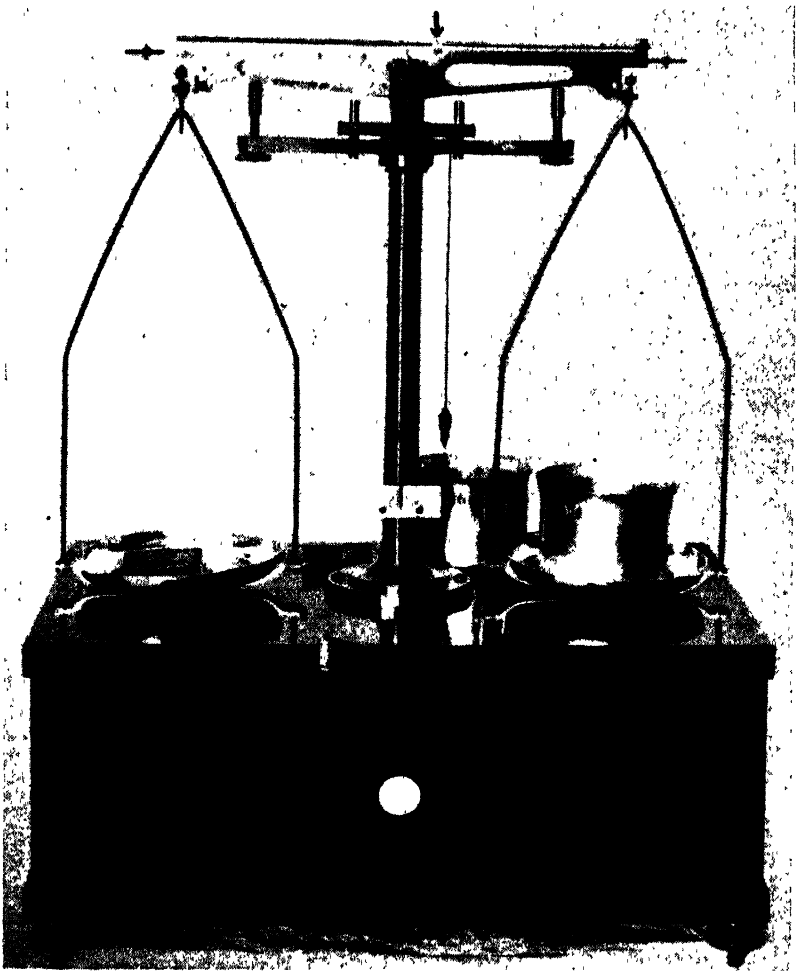


Plate 35.

Physical Balance with Attached Rider.—The cup, counterpoise, and weights are in position, and the rider is on the 0.57 gram mark, indicating 15.7 per cent. of water.

(*b*) Place the clean dry cup on the *right* pan (note the change from the usual left pan) and the corresponding counterpoise on the left pan, and see that the balance is in equilibrium. If not, adjust the counterpoise to the correct weight.

(*c*) Place a 10 gram weight on the left pan with the counterpoise.

(*d*) Place butter from the well mixed sample into the cup until the balance is again in equilibrium.

(*e*) Place the cup on the heater and shake gently during the evaporation of the water to prevent spurting. During the final stage the butter froths up in the cup, then subsides, and the fat may be seen boiling quietly. The colour will then be a light brown.

(*f*) Remove the cup from the heater and cool to atmospheric temperature in the cooling bath.

(*g*) Wipe the outside of the cup perfectly dry and replace on the left pan of the balance.

(*h*) Leave the 10 gram weight on the left pan, place a 1 gram weight on the right pan and slide the rider along the beam until the balance is in equilibrium. The weight of water in 10 grams of the butter amounts to 1 gram plus the fraction of a gram shown by the rider. This sum is recorded as C.

$$\text{Percentage of water} = C \times 10.$$

Example.—Plate 35 shows the balance with the cup and 1 gram weight on the right pan, the counterpoise and the 10 gram weight on the left pan, and the rider on the 0·57 gram mark.

Weight of water in 10 grams of butter = 1 gram + 0·57 gram = 1·57 grams.
Percentage of water = 1·57 × 10.
= 15·7.

By following this technique the position of the rider will give what almost amounts to a direct percentage reading—i.e., the rider on the 0·57 gram mark denotes 15·7 per cent., the 0·5 and 0·6 gram marks denote 15·0 and 16·0 per cent. respectively, and so on. For this reason, and because of its sensitivity and general utility, this type of balance is strongly recommended for use in a control laboratory or wherever reliable and accurate tests are required.

The Torsion Balance.

The torsion balance, illustrated in Plates 36 and 37 is a robust, reliable balance specially designed for the determination of water in butter. With a set of weights it can also be used for other work where an accuracy of less than 0·01 gram is not required. The balance has four beams fitted with non-detachable riders. One beam is fitted with a large tare or counterpoise weight (A) with which the metal cup can be roughly counterpoised. Another graduated beam has attached to it a small tare weight (B) with which the final counterpoising of the cup is performed. Two beams, each having an attached rider, are graduated in percentages, the larger (D) being from 0 to 20 per cent. in 0·2 divisions and the

smaller (C) being from 0 to 10 per cent. in 0·1 divisions. The balance is used as follows:—

(*a*) Place the percentage riders (C and D) on their respective zero marks (the left side of the rider coinciding with the 0 line at the left side of the scales), the small tare weight (B) on the zero mark in the centre of the scale, and the large tare weight (A) as far to the right of its beam as it will go. Level the balance by adjusting the levelling screws so that the pointer swings an even number of scale divisions on each side of the centre line. Do not again touch the levelling screws.

(*b*) Place the cup on the right pan. Roughly counterpoise it by sliding the large tare weight (A) to the left and screwing it in place and then counterpoise it accurately by sliding the small tare weight (B) to the right or left as required. When a number of tests are being made a number of cups of approximately the same weight (within a range of 0·5 gram) are required, and the exact position of the small tare weight (B) for each cup should be noted.

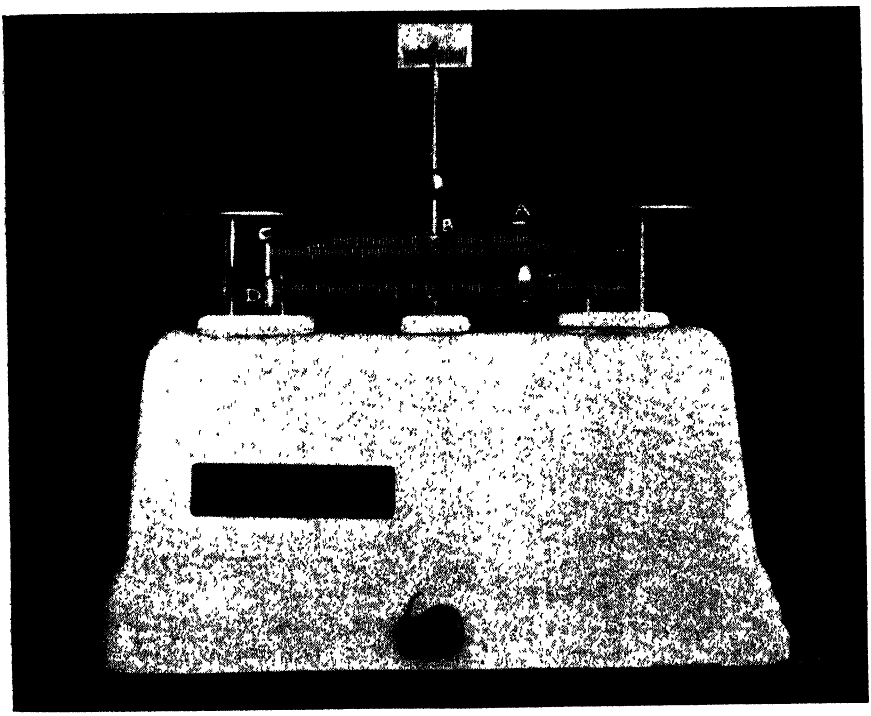


Plate 36.

THE TORSION BALANCE.—A. Large tare weight. B. Small tare weight. C. Smaller percentage rider on the 0 to 10 per cent. scale. D. Larger percentage rider on the 0 to 20 per cent. scale.

(*c*) Place the 10 gram weight on the left pan.

(*d*) Place butter from the well mixed sample into the cup until the balance is again in equilibrium.

(*e*) Place the cup on the heater and shake gently during the evaporation of the water to prevent spurting. During the final stage the butter froths up in the cup, then subsides, and the fat may be seen boiling quietly. The colour will then be a light brown.

(*f*) Remove the cup from the heater and cool to atmospheric temperature in the cooling bath.

(*g*) Wipe the outside of the cup perfectly dry and replace on the right pan of the balance.

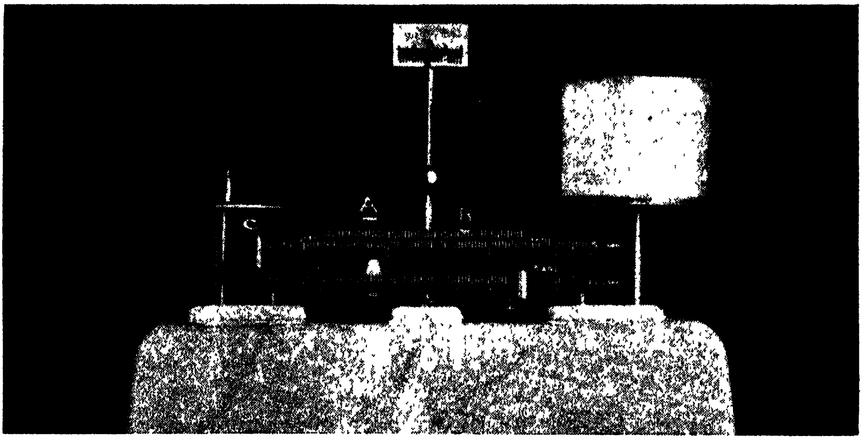


Plate 37.

BEAMS OF THE TORSION BALANCE.—Note the altered positions of the tare weights A and B. The larger percentage rider D indicates 15.6 per cent. of water.

(*h*) Leave the 10 gram weight on the left pan and slide the larger percentage rider (D) along its scale to the right until the balance is again in equilibrium. The percentage of water in the butter is obtained by taking the reading on the scale corresponding to the left-hand side of the rider. If desired, this rider may be slid along to the 10 per cent. or other mark and the smaller rider (C) used to obtain the final reading, in which case the two readings must be added together. When a number of tests are made together, the small tare weight (B) must be replaced in the correct position for each cup as determined in (*b*) above.

Example.—Plate 37 shows a close-up view of the scales showing a reading of 15·6 per cent. using the larger rider (D) only.

The One-pan Balance.

This type of balance is a one-purpose balance as it can only be used for the determination of water in butter. It also has a number of other disadvantages when compared with the physical and torsion balances, not least amongst them being the loose weights of a special design which can only be handled with the fingers, no forceps being provided with the balance. Another disadvantage is that only one test at a time can

be performed unless a number of cups of *exactly* the same weight are available. Fairly reliable results are obtainable if the balance is kept clean and the cup and weights handled only with clean dry hands. A typical balance of this type is illustrated in Plate 38. The weights supplied with the balance are a 10 gram hooked weight, a 2 gram rider, and a 0·2 gram rider. Working directions are as follows:—

(*a*) Place the clean dry cup on the pan.

(*b*) Suspend the 10 gram weight from the hook above the pan, allow the balance to swing and adjust, by means of the screw on the right of the beam, until the balance pointer swings the same number of scale divisions on each side of the centre line.

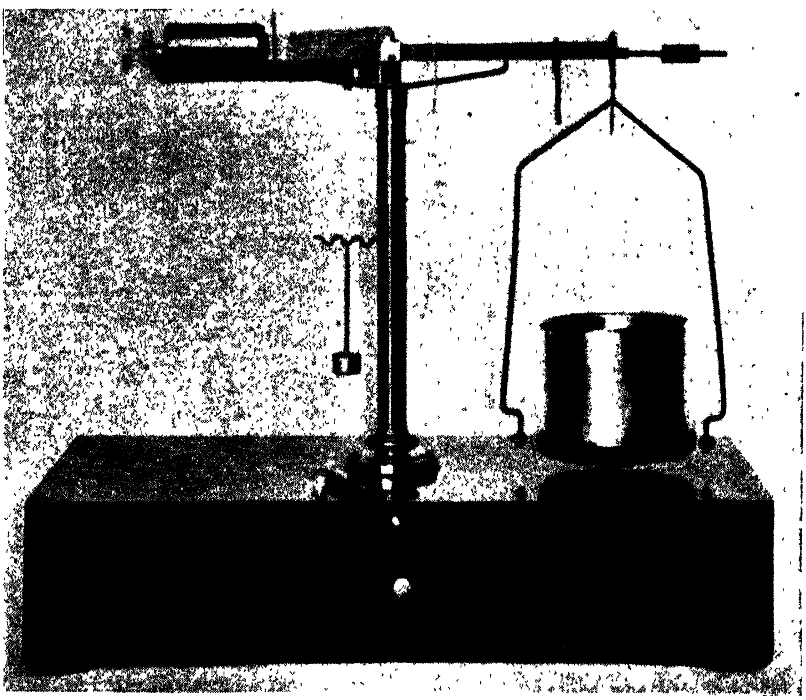


Plate 38.
THE ONE-PAN BALANCE.—The riders show 15.4 per cent.

(*c*) Remove the 10 gram weight.

(*d*) Place butter from the well mixed sample in the cup until the balance is again in equilibrium.

(*e*) Place the cup on the heater and shake gently during the evaporation of the water to prevent spurting. During the final stage the butter froths up in the cup, then subsides, and the fat may be seen boiling quietly. The colour will then be a light brown.

(*f*) Remove the cup from the heater and cool to atmospheric temperature in the cooling bath.

(*g*) Wipe the outside of the cup perfectly dry and replace on the balance pan.

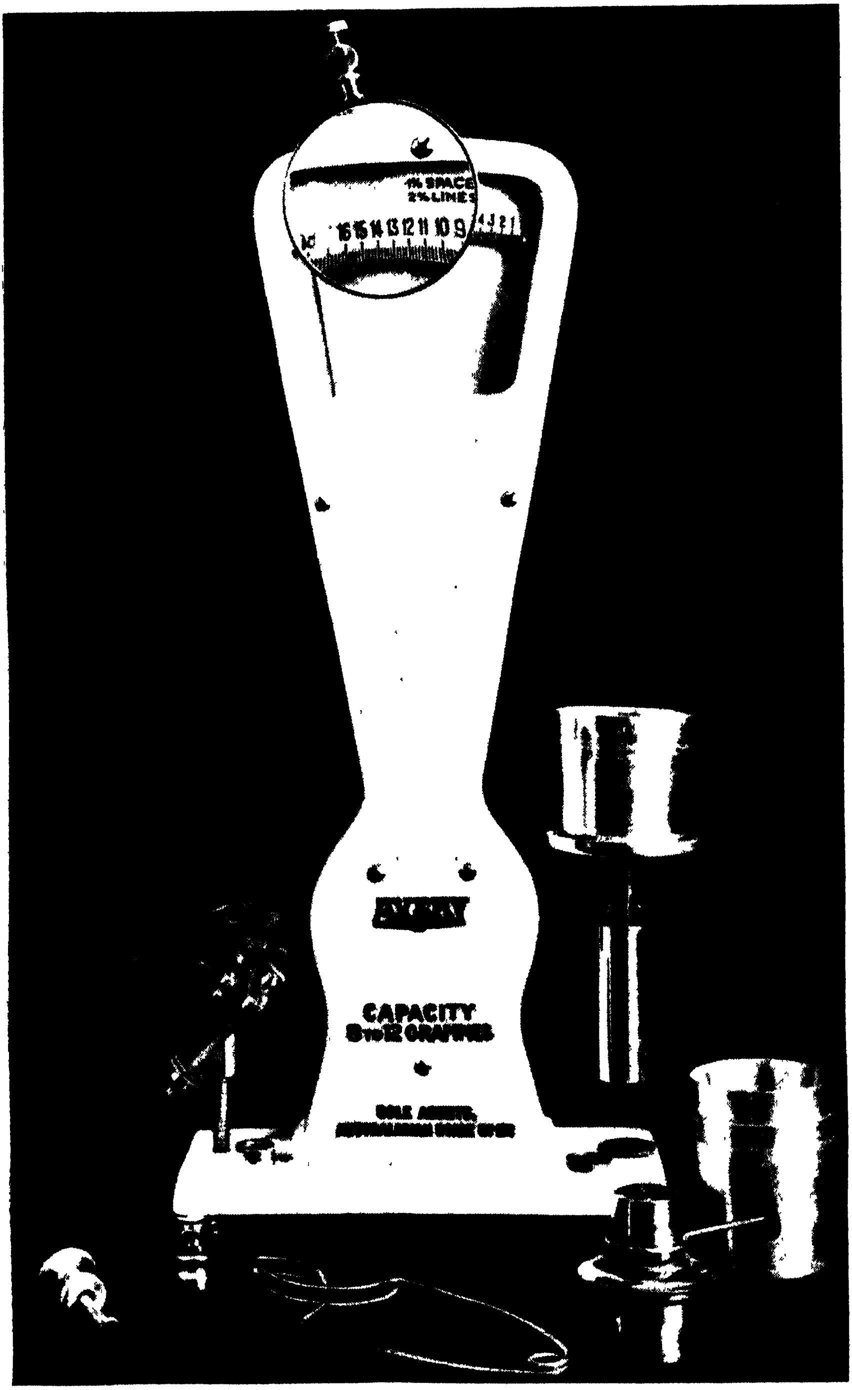


Plate 39.
THE AVERY BALANCE.

(*h*) Place the 2 gram rider on one of the percentage marks on the graduated beam, taking care that the rider is seated properly in the groove and does not touch the beam supports. If necessary, alter the position of the rider until the percentage mark lower than the true percentage is found. Then place the 0·2 gram rider on the beam in the various grooves until the balance is again in equilibrium. The percentage is obtained by noting the positions of the riders, the larger giving the whole per cent. and the smaller giving the tenths of 1 per cent.

Example.—In Plate 38 the larger rider is on the 15 per cent. mark and the smaller rider is on the 4 per cent. mark. The butter would contain 15·4 per cent. of water.

The Avery Balance.

A comparatively recent introduction is the Avery oil damped balance in which the pointer is rapidly brought to a stationary position by means of a paddle immersed in an oil bath. It is a one-purpose balance capable of being used only for the determination of water in butter. A compensating weight enables any quantity of butter between 8 and 12 grams to be taken and the percentage of water is obtained direct from the scale. It has a serious disadvantage for butter standardisation purposes, as no salt test can be performed unless the exact weight of butter taken is known. To weigh out a definite quantity of butter on this balance requires a radical modification of technique, as the balance is designed to make such a weighing unnecessary. If more than one test is to be performed, a number of cups of *exactly* the same weight are required. Constant skilled attention is required to obtain consistently accurate results. The balance is supplied with a 12 gram weight for adjustment purposes. The balance is used as follows:—

(*a*) Screw down the compensating weight as far as it will go. Plate 39 shows the correct position. Do not shift the lock nut under any circumstances.

(*b*) Place the clean dry cup and the 12 gram weight on the pan. The pointer should come to rest exactly on the 0 mark on the right of the scale. If not, adjust to the 0 mark by rotating the screw behind the bar with a turn screw, clockwise or anti-clockwise as required.

(*c*) Remove the 12 gram weight.

(*d*) By means of the butter sampler take a portion of the well mixed sample and place in the cup. Alter the position of the compensating weight until the pointer again rests on the 0 mark.

(*e*) Place the cup on the heater and shake gently during the evaporation of the water to prevent spurting. During the final stage the butter froths up in the cup, then subsides, and the fat may be seen boiling quietly. The colour will then be a light brown.

(*f*) Remove the cup from the heater and cool to atmospheric temperature in the cooling bath.

(*g*) Wipe the outside of the cup perfectly dry and replace on the balance pan.

(*h*) Read off the percentage of water from the scale.

Performing the Mules Operation on Fully Grown Sheep.

G. R. MOULE, Officer in Charge, Sheep and Wool Branch, and HAROLD POPE, Senior Adviser in Sheep and Wool.

IT is usually agreed that the ideal time at which to perform the Mules operation on sheep in Queensland is between 5 and 10 months of age, provided that black bush flies and blowflies are not active. This means that each year's drop of lambs are usually treated immediately after their first shearing and in a few years, as older sheep are cast for age, the flock becomes composed entirely of Mules treated sheep.

Advantages of Early Treatment.

The advantages of treating sheep between 5 and 10 months of age are accepted as being:—

(1) Young sheep are the most susceptible to fly strike and the early application of the Mules operation affords them protection for the maximum time and during the greatest danger period.

(2) Young sheep are lighter to handle and require less restraint.

(3) The operation need not be so radical as when performed at lamb marking, when unmothering may be an important cause of loss.

Operating on Older Sheep.

The extremely good results which have followed the application of the Mules operation to young sheep have led some woolgrowers to treat older animals. This can be done quite satisfactorily provided reasonable methods of restraint are available which will minimise the heavy work associated with catching, lifting and holding the sheep.

One device which has proved eminently satisfactory in the Maranoa during the past two years is a modification of the Bundy crush, which is used quite commonly in New South Wales. It consists of a vertical

opening in a panel of fencing around a small pen on a raised grating floor, which should be about level with the operator's belt. The opening should be between 20 and 24 inches wide and should run up the full length of the fence. A wooden or iron bar is placed horizontally across the opening about 12 inches from the grating floor. It should be possible for the operator, who stands on the ground and faces the opening, to remove the horizontal bar easily or to swing it back out of the way. He should be able to move the bar with his left hand and it should be fixed quite firmly when in position. The hinged bar shown in Plate 41 is preferable to the pull-through pin shown in Plate 40.

In Plate 40, a sheep is shown in position between the uprights which border the opening in the walls of the pen. The animal is caught by the muzzle and thrown in the same way as a shearer handles sheep which he is taking out of the catching pen. The hindquarters are then swung under the horizontal rail, so that the hocks are caught in the position shown in the illustration.

Plate 40.

Device for Holding Sheep for Mules Operation.

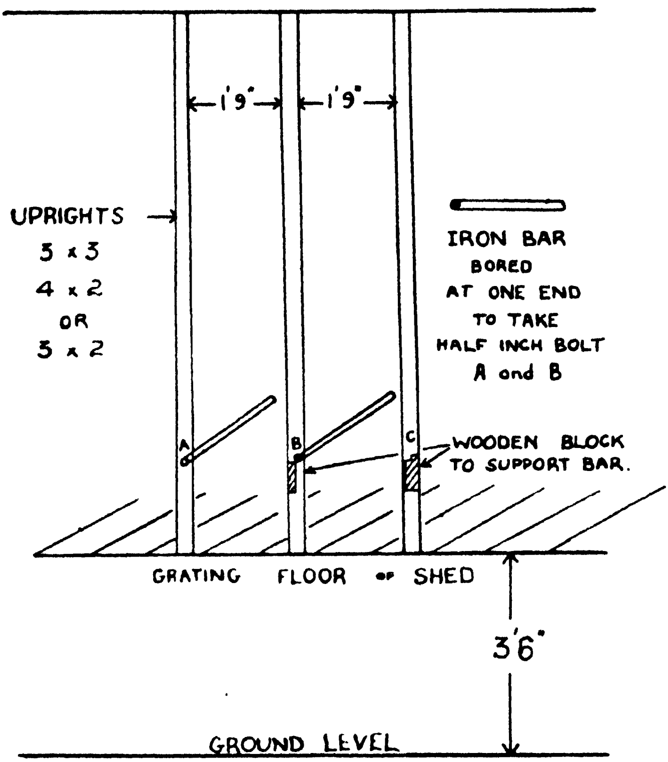


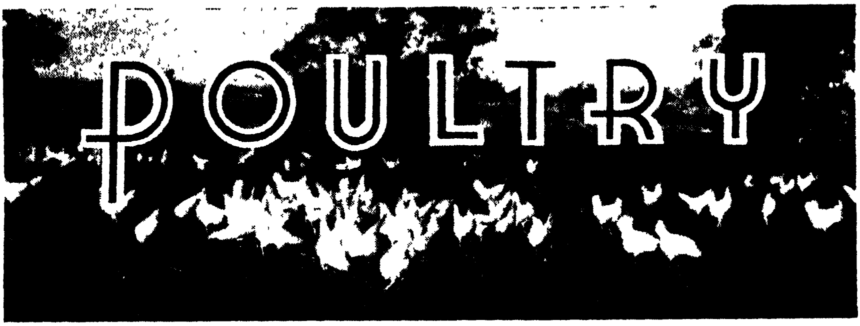
Plate 41.
SKETCH OF ALTERNATIVE DEVICE TO THAT SHOWN IN PLATE 40.

The breech of the sheep projects out towards the operator and the catcher stands with the animal's back and head resting against his legs. If necessary, he can lean over and hold the sheep's hocks against the bar.

As soon as the operation is completed the operator releases the horizontal bar and the catcher allows the sheep to fall forward on its feet and then returns the bar to its horizontal position before catching another sheep. With two catchers, each with an opening and bar, one experienced operator can treat 650 to 800 adult sheep comfortably in a day and the catchers do not show signs of fatigue.

Restraint of this type can be used for young sheep, but it is of particular benefit when adult animals are to be treated, as it obviates the heavy work usually associated with applying the Mules operation to sheep of this class.

The performance of the actual operation and the after-treatment of the sheep are similar to those with which most experienced operators are familiar. If any details of this treatment are required, wool-growers should contact the nearest field officer of the Sheep and Wool Branch.



Poultry Nutrition: Principles and Practices.

P. RUMBALL, Officer in Charge, Poultry Branch, and F. N. J. MILNE, Assistant Husbandry Officer (Poultry).

(Continued from page 38 of July issue.)

CARE OF THE MOULTING HEN.

IT is a common practice among breeders to give little attention to moulting birds. In many instances they receive nothing but a grain ration. Feathers contain a considerable amount of protein, and the most economical manner of getting birds back into production is to feed protein-rich foods as provided in a laying ration. Moulting may be induced by the feeding of nothing but grain at or about the time birds usually moult. When once the moult has commenced laying rations should be supplied, as it will take about a fortnight for the manufacture of the first egg after the moult is completed.

FATTENING.

Two classes of birds have to be considered—old hens and cockerels. The ability of the feeder to do much with old hens in good condition is questionable, but those slightly out of condition may be improved with 10 to 14 days' crate feeding. From experiments it has been found economical to rear cockerels to the various marketing stages on the growing rations used for pullets. Ten to 14 days of crate feeding for these birds would undoubtedly add to their market value. Old hens or young cockerels should be freed of external and internal parasites before being submitted to a fattening process. The crates could be small coops 2 feet wide, 3 feet deep, and 3 feet high. These crates hold about six birds, and if the floor is of wire-netting and above ground level the droppings will fall through and the birds will be kept clean. The front should be of wire or slats wide enough apart for the birds to get their heads through to feed from a trough in the front. An all-mash mixture of a relatively high protein content fed as a gruel three times a day will undoubtedly improve condition. With this system of feeding water is not necessary. Any food remaining after half-an hour should be removed in order to keep the appetite keen. A mash of equal parts maize meal and pollard, plus 10 per cent. buttermilk powder and 5 per cent. meatmeal, is suggested.

MIXING OF MASHES.

On the majority of farms the various ingredients of a mash are mixed either with a shovel upon the floor of the feed room or in a trough.

If the mash is to be fed wet it is a good practice to soak the lucerne chaff or meal in water. Just sufficient water should be used to bring the mash to the correct consistency. The salt used in the mixture should be dissolved in the water first to ensure even distribution.

In making a dry mixture the salt should be added to the protein-rich foods in order to increase the bulk through which the salt is distributed.

When using cod or other fish liver oil, an even distribution is ensured by first incorporating it in the bran.

Much labour will be saved and better mixing of the various ingredients ensured by using a mash mixer. An appliance that serves the purpose is easily constructed by the poultry raiser. The mixer consists of a drum constructed of 22-gauge galvanised sheet iron with tongued and grooved pine ends, as illustrated in Plate 42. A pipe of 1¼-inch diameter is passed through the centre of the drum, fitting into hardwood bearings at each end. This pipe can be keyed to the drum by boring a hole through the pipe close to the drum and using a piece of No. 8 wire as a key. The wire must be bolted to the drum.

The mash is mixed by a tumbling process; and to assist in raising the mash on the side of the drum while it is revolving, four battens should be attached lengthwise inside the drum 2 inches from the iron. The battens should be of 2½- by 1-inch timber.

Plate 42.
A HANDY MASH MIXER.

The diameter of the drum is 3 feet 6 inches, and the length equal to the width of the iron. The sheet iron to pass around the drum must be riveted end to end, and the sides attached to the pine ends every 2 inches with screws. A convenient sized opening, the full length of the drum, must be left for filling. A sliding close-fitting door must be provided.

FEED HOPPERS.

Hoppers constructed to permit of ready access to the mash by the birds without food wastage are essential for efficient and economic feeding. Self-feeding hoppers which hold a large quantity of food are in general use, and they possess the advantage of economy in labour, as frequent distribution of mash is not necessary; but if these hoppers are not correctly made much feed wastage takes place. They are only suited to the feeding of dry mash. Frequent inspection is essential, as the mash sometimes clogs, and the hopper must be tapped to dislodge it.

The trough type of hopper is suitable for the feeding of both wet and dry mash as well as green feed. Only sufficient feed should be distributed to last the birds one or two days. Fresh mash appears more appetising to the birds, resulting in greater consumption and production. It is also possible from a casual inspection to determine whether the supply of food requires replenishing. The birds should be allowed to consume all the dry mash in the trough at least once per week (although twice is preferred), to ensure that fresh mash is not being placed continually on the top of the stale.

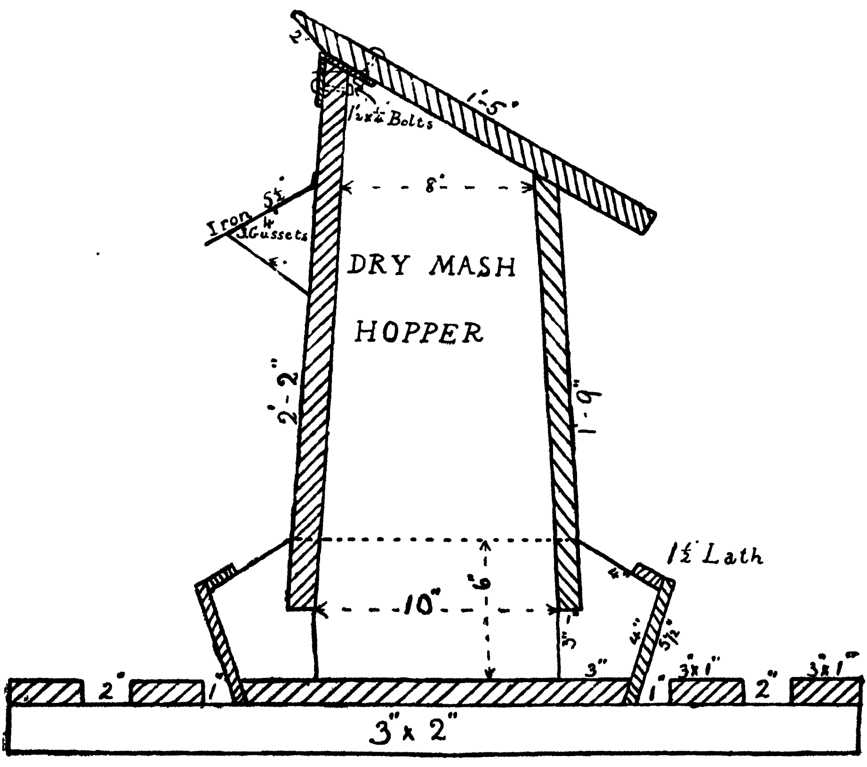


Plate 43.

A DOUBLE-SIDED SELF-FEEDING HOPPER.

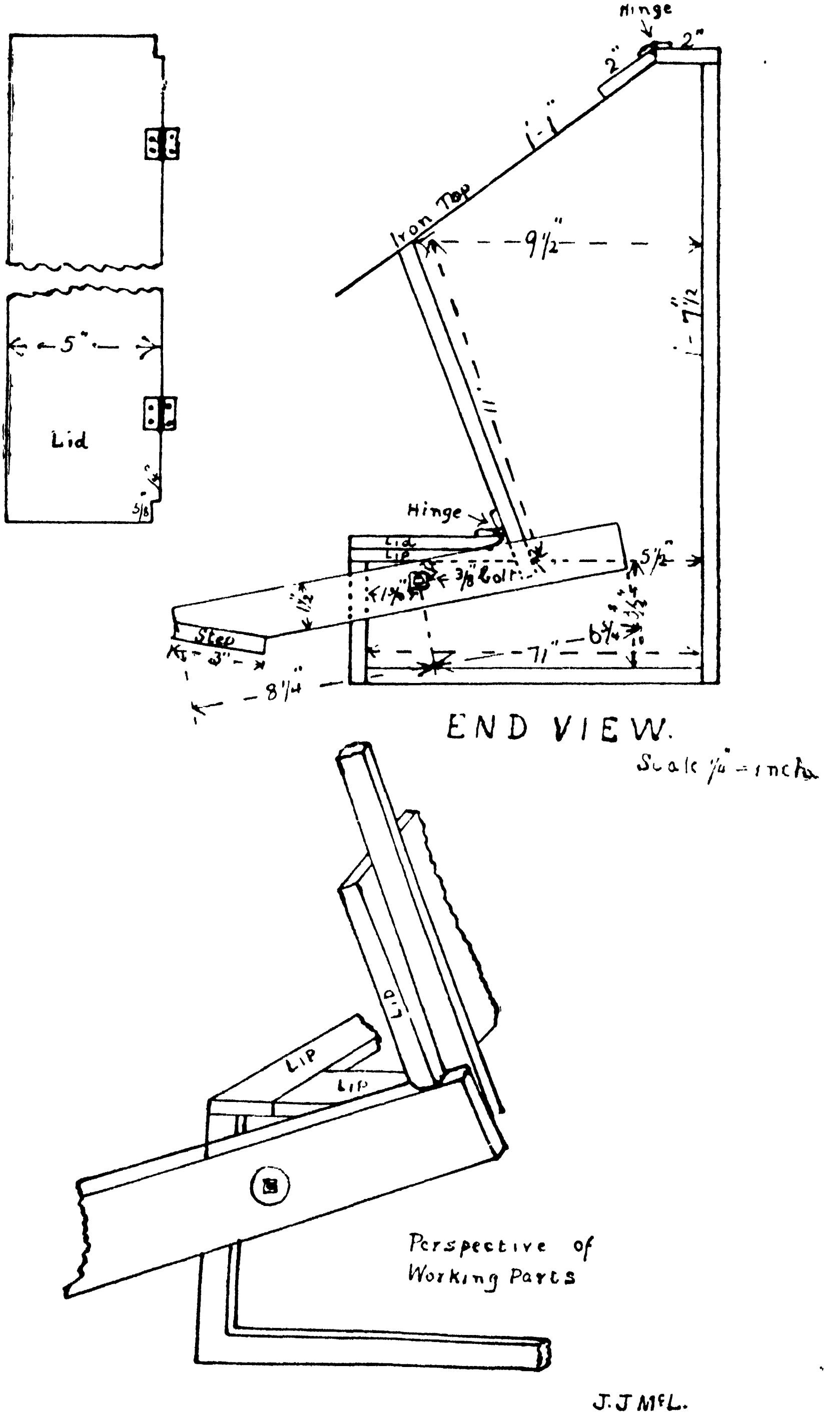


Plate 44.

PLAN OF AN AUTOMATIC FEEDING HOPPER.

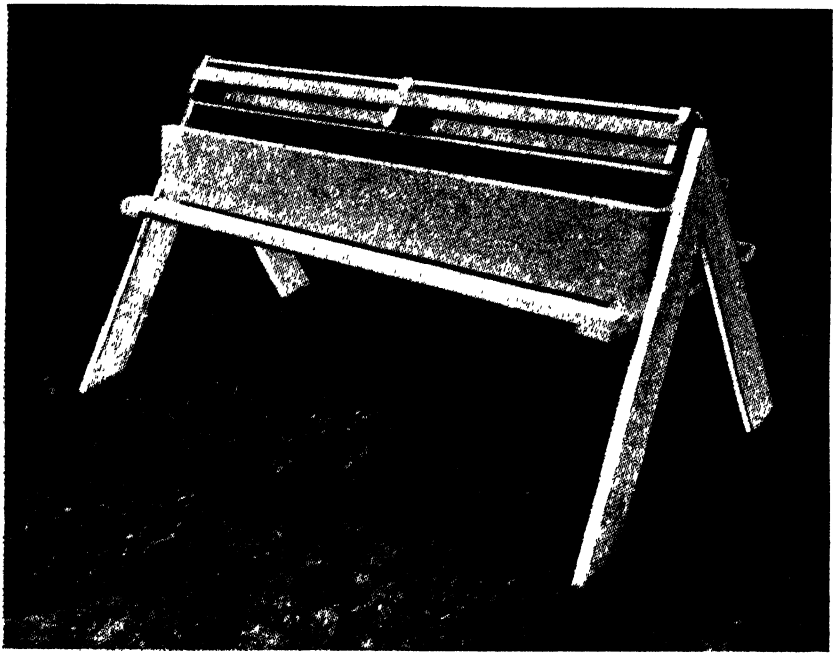


Plate 45.
Trough Feed Hopper with Roller Top.

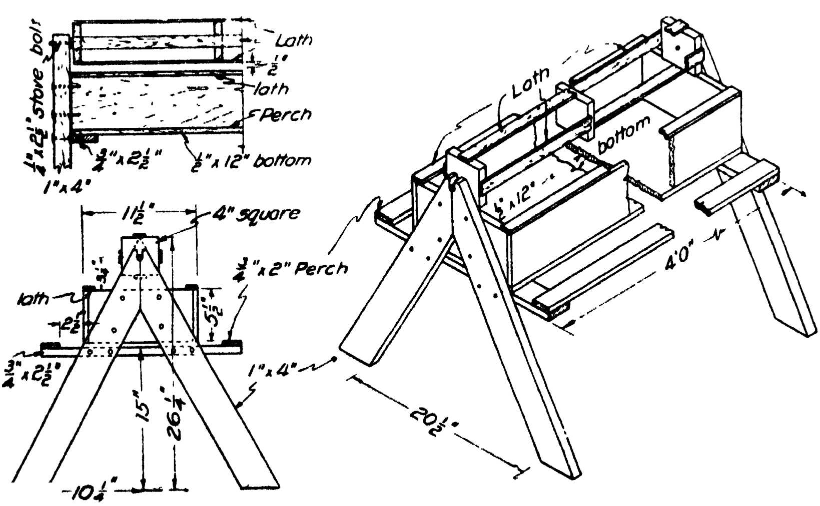


Plate 46.
Plan for the Construction of Trough Hopper Shown in Plate 45.

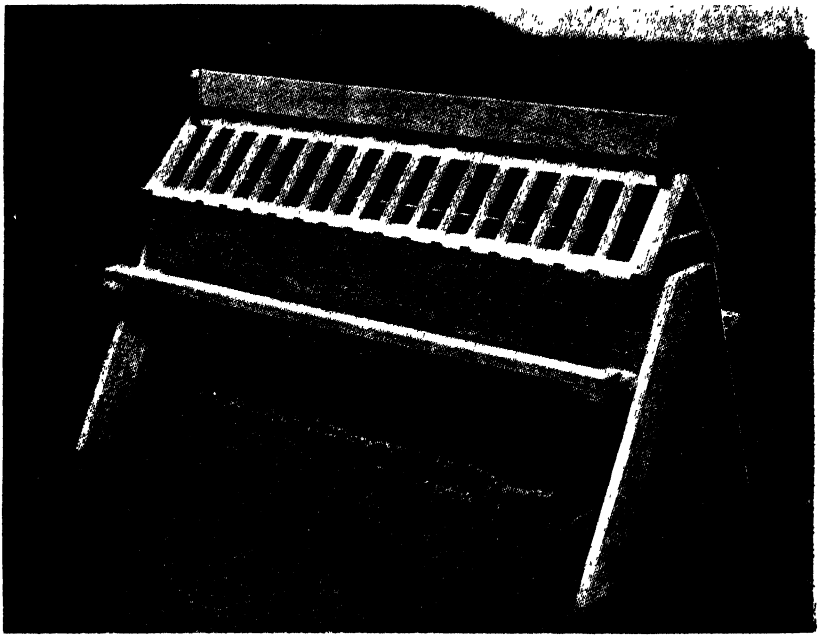


Plate 47.
TROUGH FEED HOPPER WITH SLATTED TOP.

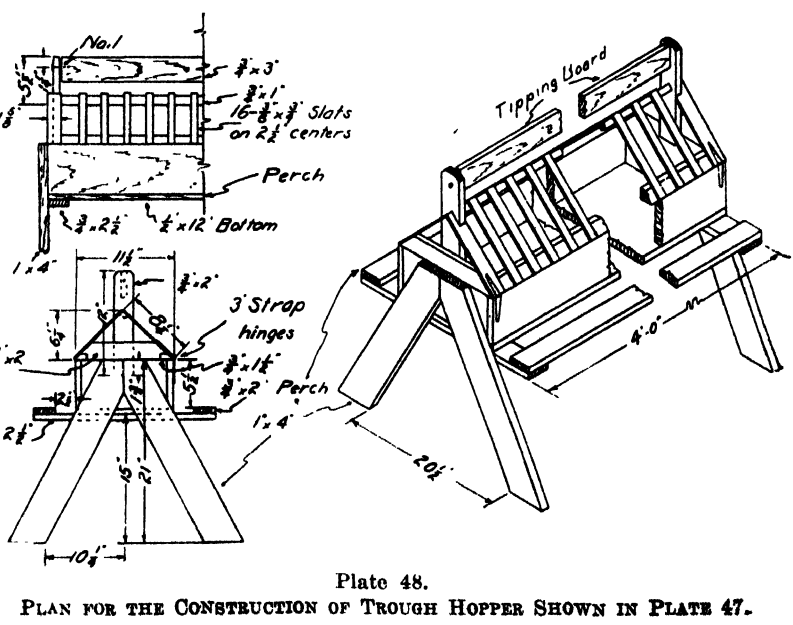


Plate 48.
PLAN FOR THE CONSTRUCTION OF TROUGH HOPPER SHOWN IN PLATE 47.

When dry mash is being fed, 1 foot of hopper space should be allowed for every 10 birds. When feeding wet mash, sufficient space should be provided to permit of all birds feeding at the same time, as the mash should be consumed before it dries out or spoils.

Plate 43 illustrates a double-sided self-feeding hopper that has proved very efficient, and Plate 44 a self-feeder that automatically shuts off the mash when the bird leaves the hopper. Plates 45 and 46 illustrate a trough hopper with a reel over the centre. As small birds are able to gain entrance to the trough between the reel and side, smaller-sized hoppers are required for growing stock. Plates 47 and 48 illustrate a trough hopper with a slatted top. These slats to some extent reduce the feeding space, but they prevent food spoilage and wastage. Hoppers may be made to any length, but it is a good plan to restrict the length in order that one person can readily move an empty hopper. Trough hoppers 4 feet in length are suggested as the maximum, and the double-sided self-feeding hopper should be no longer than 3 feet.

GREEN FEED.

Green feed has long been recognised as an important food for poultry, and fowls of all ages relish it. It is relatively rich in vitamin A and has some feeding value apart from its protein and mineral content. If green feed is used in a wet mash the amount of green feed consumed is increased. It is probably one of the best means of adding bulk to the ration. Its use also improves the hatchability of eggs and the development of growing stock. The young, tender growing portions are the most valuable.

The quantity used depends upon supplies and general conditions. When fed by itself at midday, the birds should be given as much as they will consume, and when incorporated in the mash it may constitute 25 per cent. of the bulk of the mash. The green feed should be placed in hoppers and not thrown indiscriminately about the pens. During droughty periods, when poultry foods have been costly, green feed has been used with success to the extent of 60 per cent. of the bulk of the mash supplied, but as it carries a good deal of moisture the birds are unable to consume sufficient quantities in one feed to obtain their nutrient requirements, and two feeds of such mash should be given during the day with a full evening feed of grain.

As green feed is most suited to poultry when fed in the young succulent stage, a regular supply is only possible with some form of irrigation. The economic installation of an irrigation system is a problem that is best solved by individual producers. Where it is impossible to employ irrigation owing to the cost of plant or the inability to obtain a good supply of suitable water, and where the seasons are against the growing of green feed, substitutes in the form of lucerne chaff or silage are recommended.

Lucerne is probably the best crop to grow where soil and climate conditions or irrigation facilities permit, as it is rich in protein, succulent, easily handled, and responds to repeated cuttings.

In districts where lucerne cannot be grown successfully, the finer-stemmed varieties of cowpea (summer) and field pea (winter) will provide useful substitutes.

TABLE 9.

POULTRYMEN'S CALENDAR FOR GROWING GREEN FEED.

Month.	What to Sow.	Ready to Cut in Approximately—	For Use in—
		Weeks.	
January	Millet	3	January–February
	Buckwheat	3	January–February
	Poona Pea	4	February–March
	Kikuyu Grass	8	All year in frost-free areas
	Paspalum Grass	8	All year in frost-free areas
February	Millet	3	February–March
	Buckwheat	3	February–March
	Poona Pea	4	March–April
	Kikuyu Grass	8	All year in frost-free areas
	Paspalum Grass	8	All year in frost-free areas
March	Oats	3–4	April–May
	Barley	3–4	April–May
	Wheat	3–4	April–May
	Rape	4	April–June
	Field Peas	4	April–July
	Italian Rye Grass	5	May–November
	Wimmera Rye Grass	5	May–November
	Prairie Grass	5	May–November
	Chinese Cabbage	..	..
April	Oats	3–4	May–August
	Barley	3–4	May–August
	Wheat	3–4	May–August
	Rape	4	May–July
	Field Peas	4	May–July
	Lucerne	4–6	All year round
	Italian Rye Grass	5	May–November
	Wimmera Rye Grass	5	May–November
	Prairie Grass	5	May–November
	Chinese Cabbage	..	..
May	Oats	3–4	June–August
	Barley	3–4	June–August
	Wheat	3–4	June–August
	Rape	4	June–August
	Field Peas	4	June–August
	Lucerne	4–6	All year round
	Italian Rye Grass	5	May–November
	Wimmera Rye Grass	5	May–November
	Prairie Grass	5	May–November
	Chinese Cabbage	..	..
June	Oats	3–4	July–September
	Barley	3–4	July–September
	Wheat	3–4	July–September
	Field Peas	4	July–September
	Chinese Cabbage	..	..
July	Oats	3–4	August–October
	Wheat	3–4	August–October
	Barley	3–4	August–October
	Field Peas	4	August–September
	Canary Seed	4	August–September
	Chinese Cabbage	..	..
August	Millet	3	August–September
	Canary Seed	4	September–November

TABLE 9—*continued.*

POULTRYMEN'S CALENDAR FOR GROWING GREEN FEED—*continued.*

Month.	What to Sow.	Ready to Cut in Approximately—	For Use in—
		Weeks.	
September	Millet	3	September–October
	Buckwheat	3	September–October
October	Millet	3	October–November
	Buckwheat	3	October–November
November	Millet	3	November–December
	Buckwheat	3	November–December
	Poona Pea	4	December–January
December	Millet	3	December–January
	Buckwheat .. .	3	December–January
	Poona Pea	4	January–February
	Kikuyu Grass ..	8	All year in frost-free areas
	Paspalum Grass ..	8	All year in frost-free areas

The millets, which include Japanese millet, white panicum and giant setaria, provide useful summer crops. They are quick-growing, nutritious and reasonably fine stemmed. Because of their habit of quick growth, however, successive sowings of millets are necessary to provide succulent feed over the summer season.

Young maize is also valuable, but this crop rapidly becomes coarse.

The winter cereals—wheat, oats, barley, &c.,—are particularly useful in season, and will provide excellent feed over a long period. Rape is also suitable for autumn sowing and may be fed to poultry without chaffing.

Although grasses are primarily suitable for open range, succulent grasses, such at kikuyu and paspalum (sown from December to February) and rye and prairie (sown late March to May) will provide cuttings of nutritious, easily-handled green food.

Information on green crops is summarised in Table 9.

GREEN FEED SUBSTITUTES.

Lucerne Chaff.

Lucerne chaff has been found an excellent substitute for green feed. It possesses most of the qualities of good green feed, being a relatively valuable source of vitamin A and minerals and containing some vitamin D. All lucerne chaff has not the same value, and the choicest lines are the most desirable for use in the feeding of poultry. Leafy lucerne of a good green colour is a good source of vitamin A, whilst lucerne that is bleached contains virtually none. The important factor of fibre content, together with the protein value, is illustrated in the following analyses:—

	Protein Per cent.	Fibre. Per cent.
Choice leafy lucerne chaff ..	18 to 22 ..	25 to 28
Good lucerne chaff	16 to 20 ..	27 to 30
Poor lucerne chaff	10 to 12 ..	31 to 35

Lucerne chaff for poultry should be finely cut to obtain the maximum consumption of the quantity supplied. When grain is fed it can be incorporated in the mash to the extent of 10 per cent. If the mash is to be fed in a moist state, the lucerne should be soaked before use, the time of soaking being arranged to suit the convenience of management. The quantity of water used for soaking should be just sufficient to mix a crumbly mash. This is the most economical method of using lucerne chaff as a green feed substitute.

Silage.

The feeding of silage as a substitute for green feed has proved very satisfactory in experiments conducted in the United States of America. Queensland poultrymen who have had some experience with silage speak highly of it. Silage may be made of many kinds of green feed. Legumes would undoubtedly prove the most nutritious, but barley, oats, lawn clippings, &c., will also make good silage.

Method of Preparation.—As silage for poultry is made from young growth rich in protein, it is necessary to add molasses. The material to be used should be cut, while still fresh and succulent, into lengths of about half an inch. Failing concrete silos, barrels or drums of a capacity of about 40 gallons may be used. Immediately after cutting, the material should be packed tightly in to the silo, which should be filled to the top. To each 40-gallon drum of material 2 gallons of molasses thinned with water (usually about 2 gallons) are poured over the top. The quantity of water is largely governed by the wilting that has taken place before chaffing. A weight of about 150 lb. to 200 lb. should be applied to the top of the silage, and it should then be left to stand for some time. Considerable settling down will take place permitting of more material being added the next day, after which the weight should be again applied. After a little more settling down has taken place the silo should be sealed. This is one of the most important points in the manufacture of silage. The most satisfactory procedure to adopt is to cover the silage with tarred paper or other waterproofed covering and place over it puddled clay to a depth of 2 to 3 inches. This should be inspected after about two days and again at intervals. Any cracks which appear on its surface or between the drum and the clay should be plastered with more clay. With properly sealed silage the material used retains its colour, the juices are conserved, and the development of moulds and insect larvae is checked. The development of these would make the use of the silage dangerous.

Method of Feeding.—Though they usually take to it readily, poultry may have to be accustomed to silage. The best method of introducing it to their ration is to mix it with the mash. Once they have become accustomed to it, silage may be fed as a green feed. It will be freely consumed, but 1 to 2 quarts per 100 birds will be found sufficient.

Effects of Feeding—The quality of the eggs produced by birds fed on silage is not affected, nor have any other effects depreciating its value as a poultry food been noted.

[TO BE CONTINUED.]

Leg Troubles in Toddlers.

After the thrill and joy of watching their infants gain their feet and then begin to walk unaided, many parents become concerned because "Johnny" walks with his toes turned in; he walks clumsily and frequently falls over; his legs are not straight, or his knees are knocking together.

These are very common complaints in toddlers and may or may not be of serious import for the future well-being of the child.

The causes of these defects are as yet imperfectly understood, but it is generally agreed that the milder degrees of defect may merely signify different stages in the developmental growth of the child's bones and muscles, and therefore spontaneous correction will most likely take place as the child grows older. But Nature must be assisted, or at least not hindered, and it is important to make sure that the child is in good general health; that he is receiving a diet adequate in quantity and quality, with especial emphasis on an adequate amount of protein, minerals, and vitamins; that he gets plenty of fresh air, sunshine, and exercise; and that he wears sensible shoes.

In the shaping and development of the bones, muscles have an important part to play, so it is essential that the muscles and ligaments themselves should be well developed, strong, and healthy. Many of the above distortions in toddlers' legs are caused or aggravated by lack of proper support from soft and flabby muscles and lax ligaments. What is often forgotten is that a child's bones and muscles and other growing tissues obey the same laws as do trees and other plants. It is not surprising to find the young tree arching at the behest of the prevailing wind and the old gnarled trunk bent irreparably, yet many are surprised to find a knock knee increasing instead of "being grown out of" when the child walks daily on an unyielding pavement, on the inner strap of a sandal which offers no grip to the foot muscles and allows the inner border of the foot to lie constantly on the ground.

It is important that steps to correct these faults should be taken early if the toddler is to be spared the handicap of having to wear leg irons or braces, or the necessity of operation, or, if left incorrected, ugly deformity and maybe painful arthritis in later life.

The toddler may require some additions to his diet, more sunshine, fresh air and exercise, sensible footwear. Perhaps his shoes require wedging or building up, and it is important that when a doctor prescribes built-up shoes, or better still, boots, they be worn all day and every day. Boots should be firm, fitting snugly round the ankles, with broad toes and a straight inner border.

Some special exercises are most helpful in developing and strengthening the muscles of the feet and legs and can be incorporated into the parents' playtime with their children.

Exercises.

For the Muscles of the Feet—

Encourage the toddler to actively arch his feet, claw his toes and pick up pencils or marbles with his toes.

Let him imitate you, walking on the outside edges of the feet.

If he is too young to do these tricks, tickle the arch muscles of the soles of his feet and they will contract.

For the Muscles of the Legs—

The child sits on the floor in the cross-legged position facing his mother (or father), who sits on a chair. She places her right foot as a steadying block against the inverted sole of the right foot of the child and her left to his left. She then clasps his outstretched hands and teaches him to rise slowly to the upright position, and then return slowly to the sitting position, keeping the legs crossed and inverted all the time. At first she takes most of his weight, but less and less, until he can do the exercise without assistance.

At two years or a little later the tricycle serves as good exercise for the leg and thigh muscles. The wooden bar which runs from the seat to below the handle-bars should be well padded, so that the child shoves on the pedals with the knees well apart and the legs and feet inverted.

The more fortunate child with a pony has the perfect apparatus for the correction of any tendency to knock knees.

The Battle of Food in Early Childhood.

Many modern mothers study scientific methods of feeding their children and are well versed in the principles of child nutrition and dietetics, but when it comes to putting these principles into practice many difficulties and problems are encountered.

Children, especially at the toddler stage, are all individualists and rarely conform to set rules and patterns. Their behaviour and actions are governed more by fundamental instincts and emotions than by convention, knowledge, and reason. The habits of adulthood appear automatic, subconscious, and effortless, but not so to the child, who has yet much to learn and many emotional conflicts to resolve.

The setting in which difficulties occur is of prime importance, for over food the young child can most easily try to attract attention to himself or try to dominate his parents. The child who is insecure or who feels neglected from any cause, be it family dissension, illness or loss of a parent, or a new addition to the family, will often retaliate by scenes at meal times. So will the child who is over-pampered, fussed over and spoilt and who always expects and usually gets his own way. So it will be seen that food fads are fairly common among young children and may include many forms of refusal such as finickiness, refusal of specific foods or general negativism over all meals. It is important that mothers and fathers should understand these problems so that they may be resolved sanely and calmly and not aggravated by emotional and unwise management which leads to further anxiety for all concerned.

The growth of anxiety in regard to feeding can readily be observed. The baby may not be hungry. Perhaps his gums are sore from teething. He refuses his orange juice. His mother spoons it in and the rim of the spoon knocks his sore gums. He chokes a little and the back of his throat hurts him. He screams and upsets the orange juice. His mother thinks he is just being tiresome, holds him tightly, and forces it between his lips. He may vomit a little and get wind, and so there are more screams and struggles. The battle of food has started. Next time he may remember the struggle and prepare for another—so he refuses his milk. Thus it may go on and his devoted and well-meaning mother becomes anxious lest he should lose weight. She may even summon the doctor. How much better to have waited until the baby was ready *and* hungry than to try forceful feeding. It is a mistake to allow your emotions to enter into the matter at all. This kind of anxiety is often cumulative. The child earns the reputation of a poor eater, and the mother urges, coaxes, cajoles, threatens, scolds, and finally trys to force. The child usually retaliates by vomiting or by indigestion.

Many children who refuse to eat at home will eat well at nursery school. This is not only because convention decrees it, and the teacher's attitude prevents an emotional issue arising, but also because the example of the other children is reassuring.

It is not surprising that it is the *eldest* or the *only* child of anxious parents who tends to exhibit food fads most frequently. It is natural enough that this should happen.

Unemotional unconcern is by far the best and safest cure unless the child is in poor physical health, when medical advice should be sought. It is also necessary to make sure that your child gets plenty of fresh air and exercise, that this is balanced with sufficient rest, that he does not get over-excited, that he has a quiet period before meals, and that his bowels are functioning normally.

Any further information on this and other matters connected with children may be obtained by communicating personally with the Maternal and Child Welfare Information Bureau, 184 St. Paul's Terrace, Brisbane, or by addressing letters "Baby Clinic, Brisbane." These letters need not be stamped.

ASTRONOMICAL DATA FOR QUEENSLAND.

SEPTEMBER, 1949.

Supplied by W. J. Newell, Hon. Secretary of the Astronomical Society of Queensland.

TIMES OF SUNRISE AND SUNSET.

At Brisbane.			MINUTES LATER THAN BRISBANE AT OTHER PLACES.					
Day.	**Rise.**	**Set.**	**Place.**	**Rise.**	**Set.**	**Place.**	**Rise.**	**Set.**
	a.m.	p.m.						
1	6.03	5.33	Cairns	27	31	Longreach	34	36
6	5.58	5.36	Charleville	27	27	Quilpie	35	35
11	5 52	5.38	Cloncurry	48	52	Rockhampton	9	11
16	5.46	5.40	Cunnamulla	29	29	Roma	17	17
21	5.40	5.42	Dirranbandi	19	19	Townsville	22	27
26	5.35	5.45	Emerald	18	20	Winton	38	42
30	5.30	5.46	Hughenden	33	37	Warwick	3	4

TIMES OF MOONRISE AND MOONSET.

At Brisbane.

Day.	Rise.	Set.
	a.m.	a.m.
1	11.38	1.20
	p.m.	
2	12.36	2.21
3	1.36	3.16
4	2.36	4.04
5	3.35	4.45
6	4·32	5.20
7	5.27	5.51
8	6.20	6.20
9	7.11	6.47
10	8.03	7.13
11	8.56	7.41
12	9.50	8.10
13	10.46	8.43
14	11.44	9.21
15	..	10.04
	a.m.	
16	12.43	10.54
17	1.40	11.51
		p.m.
18	2.33	12.54
19	3.22	2.01
20	4.07	3.09
21	4·47	4.17
22	5.23	5.25
23	5.59	6.33
24	6.35	7.42
25	7·12	8.51
26	7.54	10.01
27	8.40	11.10
28	9.32	..
		a.m.
29	10.29	12.15
30	11.20	1.12

MINUTES LATER THAN BRISBANE (SOUTHERN DISTRICTS).

Charleville 27; Cunnamulla 29; Dirranbandi 19; Quilpie 35; Roma 17; Warwick 4.

MINUTES LATER THAN BRISBANE (CENTRAL DISTRICTS).

Day.	Emerald.		Longreach.		Rockhampton.		Winton.	
	Rise.	**Set.**	**Rise.**	**Set.**	**Rise.**	**Set.**	**Rise.**	**Set.**
1	30	9	46	24	21	0	54	26
6	25	13	41	28	16	3	47	32
11	14	23	29	39	4	14	33	45
16	9	30	25	45	0	21	26	54
21	14	23	29	39	4	14	33	45
26	27	11	43	26	18	0	51	29
30	30	9	46	23	21	0	54	26

MINUTES LATER THAN BRISBANE (NORTHERN DISTRICTS).

Day.	Cairns.		Cloncurry.		Hughenden.		Townsville.	
	Rise.	**Set.**	**Rise.**	**Set.**	**Rise.**	**Set.**	**Rise.**	**Set.**
1	56	3	68	32	52	18	46	4
3	55	2	68	32	51	17	45	3
5	47	8	63	36	47	21	39	8
7	37	18	55	43	40	27	31	17
9	27	29	49	50	33	35	23	25
11	17	38	41	57	26	42	15	33
13	8	48	36	62	21	48	8	40
15	5	55	35	67	19	52	5	45
17	2	56	33	67	17	53	3	46
19	7	49	36	63	20	49	7	41
21	17	38	41	57	26	42	15	33
23	29	25	50	47	35	32	25	22
25	43	12	59	38	44	24	36	12
27	53	3	67	32	50	18	44	4
29	57	2	69	32	53	17	47	3
30	56	2	68	32	52	17	46	3

Phases of the Moon.—Full Moon, 7th September, 7.59 p.m.. Last Quarter, 16th September, 12.29 a.m.; New Moon, 22nd September, 10.21 p.m., First Quarter, 29th September, 2.18 p.m.

On 23rd September at 7 p.m. the Sun will cross the Equator on its apparent journey from North to South. It will then rise and set at true east and true west respectively. On the 9th and 23rd September the Moon will rise and set approximately at true east and true west respectively.

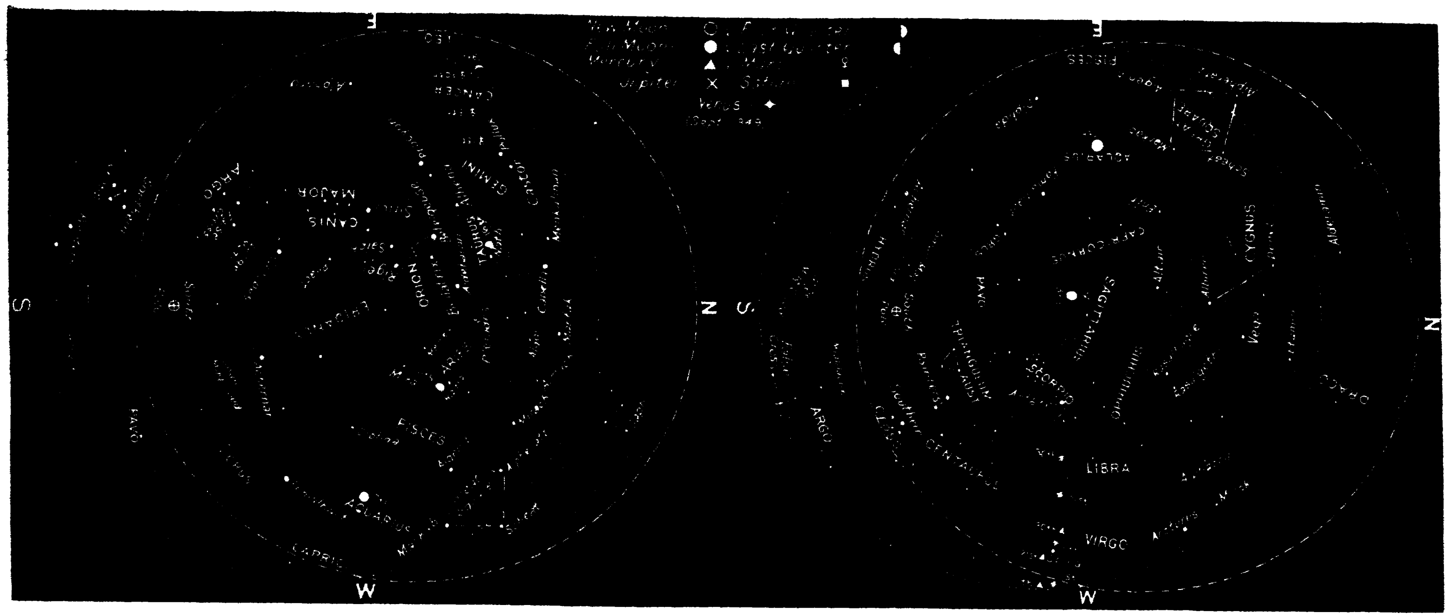
Mercury.—An evening object all this month. At the beginning of September, in the constellation of Virgo, it will set about 2 hours after the Sun and by the end of the month, still in the constellation of Virgo, it will set half an hour after the Sun.

Venus.—At the beginning of the month, in the constellation of Virgo, will set about 2¾ hours after the Sun and at the end of the month, in the constellation of Libra, will set about 3¼ hours after the Sun.

Mars.—In the constellation of Cancer, will rise about 2¼ hours before Sunrise at the beginning of September, and about 2½ hours before the Sun at the end of the month.

Jupiter.—Still a conspicuous object in the evening sky, being almost overhead at nightfall. On the 1st it will set about 4 hours after midnight and on the 30th about 2 hours after midnight.

Saturn.—Now too close in line with the Sun for observation.



Star Charts.—The chart on the right is for 7.15 p.m. in the south-eastern corner of Queensland to 8.15 p m along the Northern Territory Border on the 15th September. (For every degree of Longitude we go west, the time increases 4 minutes.) The chart on the left is for 9 hours later. On each chart the dashed circle represents the horizon as viewed from Cape York and the dotted circle is the horizon for places along the New South Wales border. when facing north hold "N" at the bottom, when facing South hold "S" at the bottom, and similarly for the other directions. Only the brightest stars are included and the more conspicuous constellations named. The stars, which do not change their relation to one another, moving east to west arrive at any selected position about 4 minutes earlier each night. Thus, at the beginning of the month the stars will be in the positions shown about 1 hour later than the time stated for the 15th and at the end of the month about 1 hour earlier than that time. The positions of the moon and planets, which are continually changing in relation to the stars, are shown for certain marked days. When no date is marked the position is for the middle of the month

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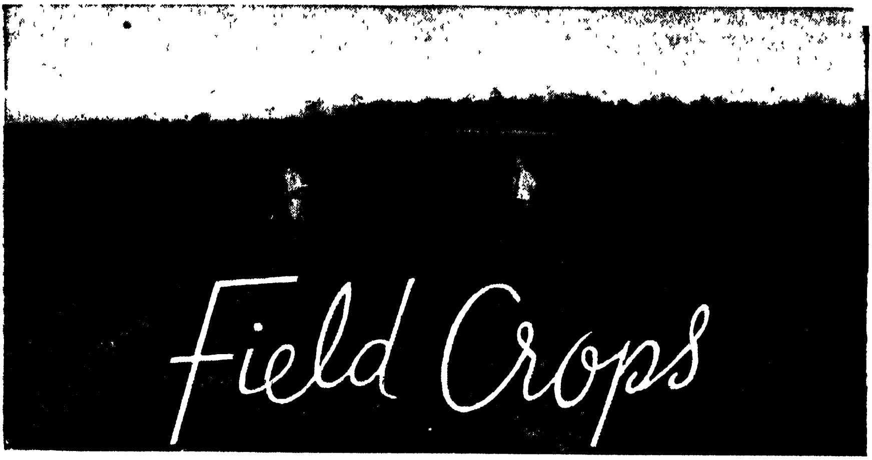
Contents



Scrub Falling by Bulldozer in Coastal Central Queensland.

E. WIDDUP, Adviser in Agriculture.

SHORTAGE of rural labour for scrub falling and land clearing operations has been a serious problem in recent years to many primary producers who desire to continue the improvement and development of their properties. The widespread use of mechanized equipment for many purposes during the war years attracted much attention from landholders who realized the possibilities of machines in overcoming shortage of rural labour in various ways. Consequently, it is not surprising that attempts have been made to adapt mechanized units in the form of bulldozers for the purpose of falling scrub.

Two bulldozer units have been operating in coastal Central Queensland almost continuously during the last two years and several thousands of acres of certain types of scrub have been cleared in a very satisfactory manner. Not all scrub types are amenable to clearing by this means; for example, in heavy scrub many trees of large diameter may be left standing and undergrowth may be insufficient to carry a good fire, which is very necessary for success in clearing land after scrub falling.

Suitable Types of Scrub.

Scrub falling by bulldozers, to which this article refers, has been successfully carried out in the districts of Milman and Marmor and in the Dalma-Raglan-Bajool area. The scrub thus treated may best be described as light (trees 4-12 inches in diameter), dense softwood or vine scrub in which common timbers are plum,[1] sarsaparilla,[2] milkwood,[3] corkwood,[4] slatewood,[5] scrub yellow-wood[6] and scrub ironbark,[7] all of

---

[1] *Pleiogynium cerasiferum.*

[2] *Alphitonia excelsa.*

[3] *Excoecaria Dallachyana.*

[4] *Erythrina vespertilio.*

[5] *Geijera salicifolia.*

[6] *Terminalia sericocarpa.*

[7] *Bridelia exaltata.*

which are of little or no commercial value. Bottle trees[1] are found in this type of scrub, but such trees are usually left standing when scrub is fallen, to be utilized for supplementary feeding in times of severe drought. The undergrowth consists, in the main, of currant bush[2] and several other species.[3] Vines are common, including native grapes,[4] nightshade,[5] caustic vine,[6] wait-a-while[7] and several other species.[8]

In these small timbered scrubs few trees exceed a diameter of one foot, and bulldozers can flatten the vegetation rapidly, especially where the soil is soft and trees are easily pushed over. Larger trees can also be handled by the bulldozers, but if there are many of them costs automatically increase.

Equipment.

Mechanized scrub falling in coastal Central Queensland is carried out by bulldozers of the 2 H.D. type, rated at 100 b.h.p. with a drawbar capacity of 85 b.h.p. and pushing hydraulic or cable operated blades 12 ft. 6 in. wide. The bulldozer weighs approximately 13 tons.

Method of Falling.

The method adopted by bulldozer operators in falling scrub is quite simple, the scrub being fallen in lands similar to ploughing practice. The elevation of the blade is adjusted to suit the type of scrub being treated; it is raised for heavy timber and lowered for lighter trees. In the types of scrub referred to in this article, the blade was operated at a uniform height of three feet, as there were no trees requiring the blade to be adjusted to a higher elevation.

The bulldozer runs over the vegetation as it is pushed down, breaking up any dead timber present. Often trees may be dragged out by the roots. As might be expected, the trees and undergrowth are compacted in the process, thus favouring good burns. With the elevation of the blade as commonly used, there is no risk of piling earth over the vegetation and so spoiling the burn. Occasionally small "whipstick" suckers pass under the blade and are not broken, but they are of relatively little importance. Normally their eradication is not a problem and in any case the subsequent fire destroys a large percentage.

The bulldozer can be used satisfactorily for falling scrub on pronounced slopes, but in extreme cases, if the country is considered worthy of clearing, axe work is required.

The rapidity with which large areas of suitable scrub can be fallen compared with axe work is a major advantage of mechanized scrub falling. Another favourable factor is the absence of stumps. Thus, the treated scrub land after burning could be brought under the plough in much quicker time, with small expense for further stumping, if it was decided to cultivate for crops.

---

[1] *Brachychiton rupestre.*

[2] *Carissa ovata.*

[3] *Alyxia ruscifolia, Heterodendron diversifolium, Acalypha sp., Citriobatus spp., Macropteranthes fitzalanii, &c.*

[4] *Vitis spp.*

[5] *Solanum seaforthianum.*

[6] *Sarcostemma australe.*

[7] *Cudrania javanensis.*

[8] *Cynanchum boromanii, Parsonia lenticillata, &c.*

Costs.

In the following table are shown the costs of falling scrub by bulldozer. These are actual figures obtained from property owners who have employed contractors on the work.

District.	Acres Fallen.	Cost per Acre.	Success of Burn
		£ s. d.	
Marmor ..	100	3 0 0	Fairly good
Raglan ..	200	3 0 0	Fair
Raglan ..	200	3 0 0	Excellent
Milman ..	100	2 10 0	Good
Milman ..	100	2 10 0	Very fair
Bajool	70	2 10 0	Good
Bajool	80	2 10 0	Good
Marmor ..	70	2 10 0	Excellent
Dalma	140	2 10 0	Fair to good

In the second last and last example shown in the table, some scrub fallen by contract axe work on each property cost £4 and £4 5s. per acre respectively. Thus not only did mechanized scrub falling do a better job but the cost per acre was less.

The price of scrub falling by bulldozer was about £5 per hour in June, 1949.

As a result of experience over the last two years it would appear that scrub falling by bulldozer may be carried out satisfactorily at any period of the year if weather conditions are suitable, as no material difference has been observed between scrub areas which were fallen during different seasons.

Treatment of Scrub after Falling.

After falling, the scrub is burnt; as already indicated, the compaction of the fallen vegetation by the bulldozers favours good burns. The general opinion of landholders is that the interval between falling and burning is much shorter with scrub fallen by bulldozer than is the case with axe work. In one exceptional case during hot dry weather an excellent burn was reported after a lapse of only 10 days from the completion of falling. Should the burn be unsatisfactory, however, the landholder is faced with precisely the same problem as falling by any other method—that is, the unburnt timber has to be collected in heaps and fired.

The general rule is to sow the burnt areas to Rhodes grass pasture following the burn as soon as the ash is cold. This is a desirable course to adopt, particularly on hilly country, where erosion of bare ground can be serious. The grass cover after it has seeded may be fired at suitable intervals to eliminate any unburnt timber and suckers.

Few landholders try to grow a cash crop following the burn, but maize and cotton could be grown and the grass seed sown when these crops were ready to harvest.

Re-suckering in the scrub areas under consideration has been negligible to date, particularly where good stands of Rhodes grass have been obtained. It is, however, too early to generalise in this regard, but it would appear most unlikely that re-suckering would be any worse following scrub falling by bulldozer than would be the case following the orthodox axe method.

Conclusion.

On results to date, the indications are that falling by bulldozer of the vine scrub type described is superior to ordinary axe work. The bulldozer method, therefore, should prove of great value to landholders in overcoming the problem of shortage of rural labour for this class of work.

Plates 49–55 illustrate various features of the operations.

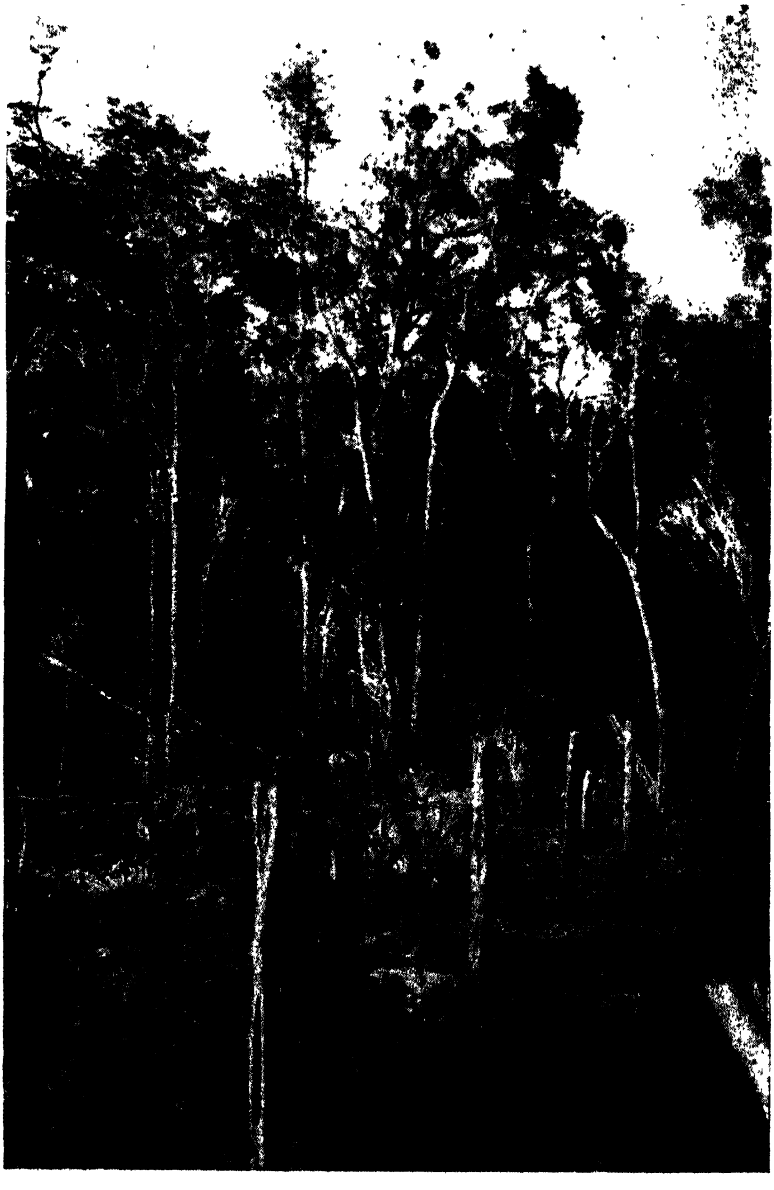


Plate 49.
TYPE OF SCRUB IN THE RAGLAN DISTRICT SUITABLE FOR FALLING BY BULLDOZER.

Plate 50.

TYPICAL SCENE AFTER FALLING BY BULLDOZER.—Note the bottle trees left standing.

Plate 51.

APPEARANCE OF LAND AFTER SCRUB FALLEN BY AXE HAS BEEN BURNT (MARMOR DISTRICT).

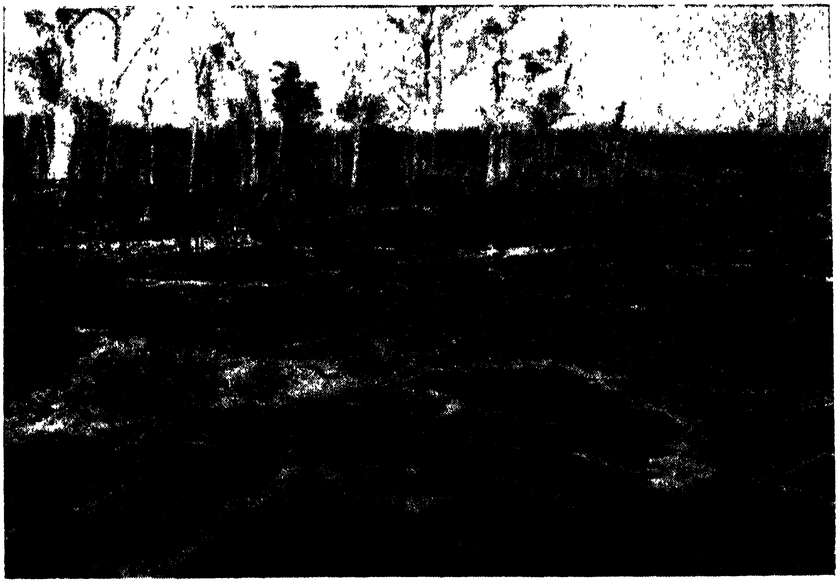


Plate 52.

APPEARANCE OF SCRUB ADJACENT TO THAT SHOWN IN PLATE 51 AFTER BURNING.—In foreground, scrub fallen by bulldozer; in background, scrub fallen by axe.

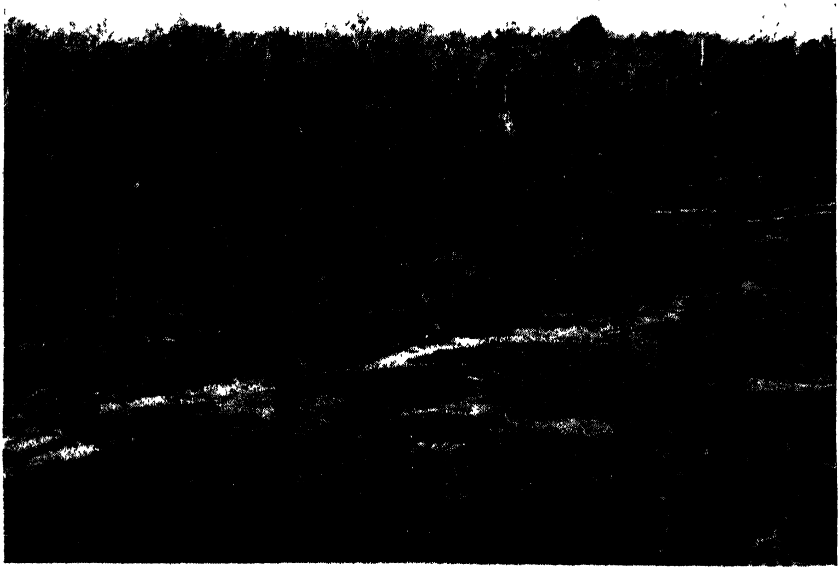


Plate 53.

SCRUB FALLEN BY AXE AND BURNT (DALMA DISTRICT).—Note young maize plants among the numerous unburnt stumps.

Plate 54.

THIS AREA, ADJACENT TO THAT SHOWN IN PLATE 53, WAS CLEARED BY BULLDOZER.—Note absence of residual stumps after burning.

Plate 55.

GRASSED AREA AFTER FALLING BY BULLDOZER AND BURNING.—The scrub was fallen in July, 1948, burnt off in November, 1948, and Rhodes grass sown in December, 1948. Note absence of stumps and the bottle trees left standing. Photograph taken March, 1949.

Lime for Agricultural Purposes.

F. B. COLEMAN, Standards Officer.

LIME for agricultural purposes is classified under the *Fertilizers Act of* 1935 as follows:—

(1) Burnt lime, caustic lime, or quicklime—consisting chiefly of lime in the form of calcium oxide (CaO); or

(2) Slaked lime, air-slaked lime, mild lime, hydrated lime—consisting chiefly of lime in the form of hydrate of lime ($CaOH_2$) and/or carbonate of lime ($CaCO_3$), obtained by the slaking of burnt lime; or

(3) Processed lime—consisting of a by-product from a process—chiefly lime in the form of hydrate and/or carbonate of lime; or

(4) Pulverised limestone, marble, coral, or shells—consisting chiefly of lime in the form of carbonate of lime ($CaCO_3$) obtained by crushing or pulverising; or

(5) Earthy lime—consisting chiefly of lime in the form of carbonate of lime ($CaCO_3$) obtained by excavation of the natural substance; or

(6) Gypsum—consisting of lime in the form of hydrated sulphate of lime ($CaSO_4 2H_2O$).

Such classification of lime is based on terms in common use, which describe the process of preparation or manufacture to which the limes concerned have been subjected.

In order to fully understand the article, it is necessary to note that 56 per cent. calcium oxide—or lime (CaO) as it is commonly known—is equal to 100 per cent. calcium carbonate ($CaCO_3$); this may be explained by saying that 56 tons of pure burnt lime, containing 100 per cent lime (CaO), is equal to 100 tons of pure limestone, containing 100 per cent. calcium carbonate ($CaCO_3$).

As lime (CaO) is present, either free or combined with other elements, in all limes for agricultural purposes, it is used as a unit of measurement by analytical chemists in order to evaluate these materials.

Thus, pure limestone is not stated on analysis to contain 100 per cent. calcium carbonate ($CaCO_3$), but to contain 56 per cent. lime (CaO) as or in the form of calcium carbonate.

A description of limes for agricultural purposes and matters dealing with their origin, composition, and value are dealt with below.

BURNT LIME.

Burnt lime is obtained in the following way:—Limestone is first quarried and broken into fairly small pieces. These pieces are placed in alternate layers in a kiln with fuel—in Queensland usually wood—which is ignited. The heat serves to liberate the carbon dioxide from the calcium carbonate, leaving calcium oxide and a quantity of impurities proportionate to the purity of the original limestone.

Pure limestone would contain 56 per cent. lime (CaO) and 44 per cent. carbon dioxide; pure burnt lime would contain 100 per cent. lime (CaO) actually in the form of calcium oxide. In actual fact the minimum purity of good burnt lime can be accepted as 90 per cent. lime (CaO). It should be emphasised that the impurities mentioned above, consisting of iron, alumina, magnesia, silica, &c., are naturally present in limestone, and cannot without great expense be removed; moreover, in normal proportions they do no harm and can be disregarded.

It is essential that the limestones should be completely burnt, otherwise the purchaser is buying some of the original limestone at the price of burnt lime.

In this connection it may be mentioned that limestone (or coral) can only be completely burnt in a properly constructed brick or brick lined kiln; "open-kiln" burning as practised in the past (consisting of logs built round the broken material) is not successful in giving a complete "burn."

An analysis of burnt lime indicates whether the limestone has been completely burnt; even if the burnt lime has been partially slaked it is still possible to determine this, providing the sample analysed is representative of the bulk.

In addition, a physical examination of badly burnt lime reveals in the resultant product "cores" of unchanged limestone which will not break down on slaking.

Burnt lime slakes under normal atmospheric conditions, taking in carbon dioxide and water from the air and "altering" from calcium oxide to a mixture of calcium hydroxide and calcium carbonate. This slaking may be considered in two steps:—

At first the calcium oxide alters to calcium hydroxide and calcium carbonate, with calcium hydroxide in much greater proportion than calcium carbonate.

An analysis would show, say—

50 per cent. lime (CaO) as calcium oxide.

30 per cent. lime (CaO) as calcium hydroxide.

4 per cent. lime (CaO) as calcium carbonate.

When the whole of the oxide has "altered," the proportions of the hydroxide and carbonate would be represented by, say—

0 per cent. lime (CaO) as calcium oxide.

60 per cent. lime (CaO) as calcium hydroxide.

10 per cent. lime (CaO) as calcium carbonate.

This slaked lime would then gradually "alter" until it becomes all carbonate, an analysis revealing, say—

55 per cent. lime (CaO) as calcium carbonate.

This is then a stable article, and undergoes no further change under atmospheric conditions.

Following on the above, it may be assumed that an analysis of—

50 per cent. lime (CaO) as calcium oxide,

30 per cent. lime (CaO) as calcium hydroxide,

4 per cent. lime (CaO) as calcium carbonate,

represents a well-burnt lime that has partially air-slaked.

An analysis such as the following, however, would indicate by the excess of calcium carbonate, compared with calcium hydroxide, the presence of unburnt calcium carbonate, and consequently could be assumed as being a partially-slaked, badly burnt lime:—

50 per cent. lime (CaO) as calcium oxide.
7 per cent. lime (CaO) as calcium hydroxide.
22 per cent. lime (CaO) as calcium carbonate.

Of course the following—

70 per cent. lime (CaO) as calcium oxide,
0 per cent. lime (CaO) as calcium hydroxide,
16 per cent. lime (CaO) as calcium carbonate,

is obviously a freshly-prepared, badly burnt lime.

It must be noted that the percentages given are *calcium oxide* (CaO)—not calcium hydroxide ($Ca(OH)_2$) or calcium carbonate ($CaCO_3$).

When a farmer realises that burnt lime slakes even under normal atmospheric conditions, and its percentage of calcium oxide (CaO) and its neutralising value become lower, it is easy to see that burnt lime should be packed and railed as *freshly burnt* material. If the material has started to slake before being packed and weighed, the purchaser is buying and paying freight on partially slaked lime, which, as above stated, has a lower percentage of lime (CaO) and lower neutralising value.

Thus, a person who pays for burnt lime and asks the manufacturer to slake it for him, unless he gets the *increased "weight equivalent"* of slaked lime, is losing badly on the proposition; in any case he is paying freight on carbon dioxide and water that could be added to the burnt lime on his own property.

Burnt lime should be purchased on the basis of net weight at the place of burning—which in North Queensland is usually some distance from the coast—as, during transit to the coast, an increase in weight could occur (due, as above stated, to taking up of carbon dioxide and moisture) before weighing; if weighed at the coast this increase would be included in the net weight charged for. In other words, 10 tons of burnt lime at the kilns could weigh 11 tons on the coast, with a consequent increased cost to the purchaser.

Ground Burnt Lime, as its name indicates, is burnt lime that has been pulverised by machine without first slaking. One such product is now being offered for sale in Queensland.

The farmer in this case must weigh the additional cost of the material against any advantage in fineness, taking into consideration the fact that although he can easily slake unground burnt lime on his own property, there is no additional freight cost (as with slaked lime) involved with ground burnt lime, providing it is bagged and railed immediately.

Of course the fine state of division would accelerate slaking considerably, and this would not be apparent from appearance—as the original material is already in a fine state.

Packing in water-proof paper bags (similar to cement bags), however, eliminates any disadvantages that may normally be associated with such an active substance in transit, storage, or handling.

SLAKED LIME.

This may be of two main types:—Air-slaked lime and hydrated or water-slaked lime.

Air-slaked Lime.—This, as mentioned above, is obtained by exposing burnt lime to the slaking effects of the atmosphere. An explanation of the action has been set out previously.

The slaked lime made by farmers from burnt lime is usually air-slaked lime, that is, the burnt lime is dumped in heaps on the field, allowed to break down, and then spread and worked in.

The proportion of calcium oxide present and the forms in which it occurs at the time of application to the soil vary with the progress made in the process of slaking; this, of course, causes complications with respect to the amount of lime to be applied.

If burnt lime is purchased, the purchaser should apportion the lime actually applied to the soil into the same number of units as he planned for the original burnt lime.

For instance:—

A farmer buys 10 tons of burnt lime with a neutralising value of 160, planning to apply $\frac{1}{2}$ ton per acre to 20 acres.

When slaked ready for use the total weight may have increased to, say, 12 tons with a neutralising value of $133\frac{1}{3}$—which figure was, of course, reduced from 160 by the slaking. It should be noted that, by slaking, the neutralising value is reduced.

The lime should still be divided into twenty lots and applied as planned, but the actual weight per acre will now be $\frac{12}{10} \times \frac{1}{2} = \frac{12}{20}$ ton $= 12$ cwt. instead of 10 cwt.

The actual weight of lime (CaO) applied to the soil will be the same, however.

This is demonstrated thus:—

10 cwt. x neutralising value 160 $= 1,600$

12 cwt. x neutralising value $133\frac{1}{3} = 1,600$

The neutralising value bears an approximate ratio to the lime (CaO) percentage.

If burnt lime is emptied direct from the bags into heaps on the ground to which it is to be applied, any increase in weight, &c., need not be considered.

Hydrated or Water-slaked Lime.—A more rapid and effective method of slaking can be obtained by adding measured amounts of water to burnt lime; this produces a rapid chemical change, with evolution of heat, and results in a fine, even, white powder, termed hydrated or water-slaked lime.

With a correctly made water-slaked lime the amount of water added is about one-third of the weight of the original burnt lime. The resultant product should be practically all calcium hydroxide ($Ca(OH_2)$), and should give a minimum analysis of 70 per cent. lime (CaO) as calcium hydroxide.

Possibly owing to lack of experience in this method of slaking, and the necessity for careful control with respect to proportions, &c., in order to obtain a consistent product, water-slaked lime for agricultural purposes is very scarce in Queensland.

To correctly manufacture commercially, an hydrating plant is necessary.

Of course, although hydrated lime is more active and more water soluble than air-slaked lime, it gradually alters to air-slaked lime on exposure, changing in time from practically pure calcium hydroxide to practically pure calcium carbonate.

There is not much of any slaked lime sold in Queensland.

PROCESSED LIME.

In certain industries various forms or compounds of lime are used in chemical processes, and a resultant lime by-product is obtained. The common types of "processed" limes—as these are designated—are set out below.

Gas Lime.—In the ammonia-recovery process associated with the gas industry, burnt lime is used; the spent lime consists chiefly of calcium carbonate and hydrate together with certain impurities such as sulphides—when freshly run off. On exposure to sun and air, however, the material becomes practically all carbonate, while the impurities are oxidised to harmless compounds. A recognised lime for agricultural purposes is obtained after drying and grinding.

Carbide Lime.—In the manufacture of acetylene, calcium carbide and water are used, giving as a waste by-product—when fresh—lime chiefly in the form of hydrate.

This lime also needs to be exposed to the atmosphere, dried and ground. Obviously, after long exposure, carbonate would be formed.

This form of processed lime is, in Queensland, naturally limited in supply, and to date it has not been considered worth commercialising.

[TO BE CONTINUED.]

VEGETABLE PRODUCTION

Tomato Seed Certification.

A. A. ROSS, Horticulturist, and K. G. FISHER-WEBSTER, Manager,
Maroochy Experiment Station.

BOTH yield and market quality of the tomato varieties grown throughout the State have frequently been unsatisfactory and this may, in part, be responsible for the low market returns sometimes received by growers. Experimental work has, therefore, been carried out in the Stanthorpe district during the past four seasons to determine the varieties most suited to the Granite Belt and ultimately to produce pure strains of seed which could be planted with confidence by commercial growers in that district.

Many varieties obtained from a number of sources were grown in the initial tests and pure strains of the best of these were developed later by selection methods. Trials were then conducted to determine which of these varieties embodied desirable characteristics such as high yields, good plant type, desirable fruit shape and quality, carrying capacity and resistance to drought, sunscald and cracking. As a result of this work, the four best varieties were selected as a basis for the establishment of a seed certification scheme. These four varieties produce fruit of excellent quality and, as they mature at different periods, all can find a place in tomato production on one and the same farm.

Production of Certified Seed.

The Tomato Seed Certification Scheme is administered under *The Seed Acts, 1937 to 1941* by a Departmental Seed Certification Committee. It is designed to ensure that supplies of good quality tomato seed, free from disease and true to type, will be available to growers. A brief outline of the rules and regulations governing tomato seed certification will indicate the care taken in the production of certified seed.

The grower who is granted registration of an area for the production of certified seed is supplied with mother seed of an approved variety for sowing. This seed is usually obtained from a single plant selection in a certified crop grown during the previous year and harvested by the Seed Certification Officer. The registered area is inspected when the seed-bed is established and sown, between germination and transplanting, when seedlings are transplanted into the field, between flowering and the time at which the first-formed tomatoes reach the mature green state, just prior to harvesting, at harvesting, and during seed cleaning and packing.

[*Photograph by S. H Mitchell.*

Plate 56.

A TYPICAL PLANT OF VARIETY Q1 (DERIVED FROM SIOUX).—Note the spreading habit of growth and the type of foliage.

A crop is rejected for certification if—

(1) at any time excessive weed growth prevents thorough inspection;

(2) bacterial canker appears in the registered area;

(3) the total number of plants showing symptoms of Fusarium wilt during the life of the crop exceeds 1 per cent. and they are not rogued out immediately;

(4) plants showing symptoms of virus diseases have not been rogued out promptly;

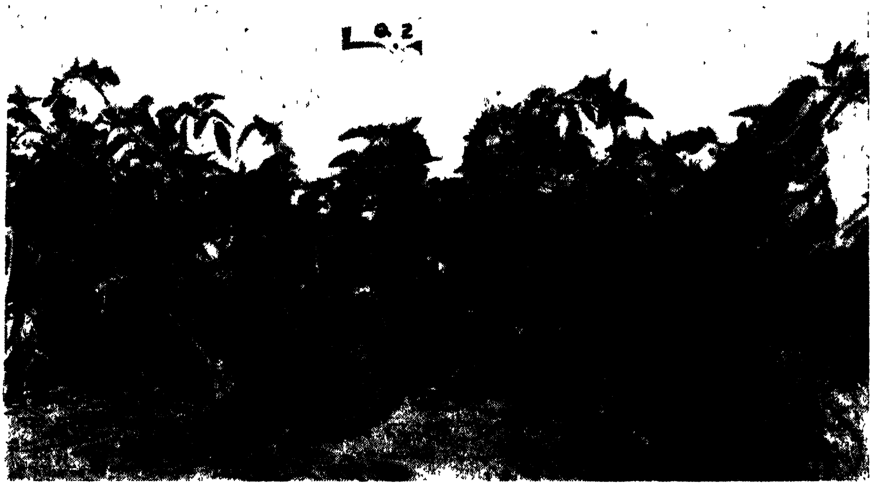
(5) the incidence of any disease may adversely affect the crop yield or quality of the seed extracted from the fruit;

(6) any plants showing undesirable varietal characteristics are not rogued out as directed;

(7) fruit is picked for market from the whole or part of the crop before the collection of fruit for the extraction of certified seed is completed;

(8) pests and diseases are not effectively controlled.

Only sound, full-ripe fruit, two inches or more in diameter, is harvested for seed. The fermentation method of cleaning, which entails extraction of the seed and juice from the fruit with a minimum of pulp, is practised. After the seed is washed and thoroughly dried, it is sampled and sealed with a temporary label by the Seed Certification Officer. The sample is tested for germination and if all requirements for certification are satisfied the bulk is weighed out and repacked under supervision.



[Photograph by S. H. Mitchell.

Plate 57.

A TYPICAL PLANT OF VARIETY Q2 (DERIVED FROM GROSSE LISSE).—Note the medium-sized plant of semi-erect habit.

Certified Varieties.

Four varieties were approved for certification during the season 1948-49 in the Stanthorpe district, and the crops grown in all registered areas were very good. An outline of the origin of each certified variety and its growth behaviour under Stanthorpe conditions may assist intending growers when selecting the type best suited to their own district. Experimental work to determine the behaviour of the certified varieties in other parts of the State is already in progress.

Q1.

Derived from Sioux, an introduction from Nebraska, U.S.A., and evolved from a cross between All Red and Stokesdale. It has a medium-sized, very open, sprawling type of non-determinate bush with long, narrow, tomato-type leaves (Plate 56). The fruit (Plate 60) is large, circular in transverse section and slightly flattened in longitudinal section. The mature fruit is pale green in colour, with no darkening of the shoulders, and it ripens to a bright red.

Q1 is a first early tomato which is ready to harvest 10 weeks after transplanting and yields heavily until final picking. The variety stands up well to variable weather conditions, cracking and sunburn being very rare in the fruit. The quality of the fruit is excellent and it carries well to southern markets

Q2.

Derived from Grosse Lisse, which was introduced from northern Africa into Australia in 1939 by the New South Wales Department of Agriculture.

The bush is medium-sized, semi-erect, non-determinate, with foliage of moderate density (Plate 57). The leaves are long and broad and of the normal tomato type. The fruit (Plate 60) is large, circular in transverse section and slightly pointed in longitudinal section. The mature fruit is pale green in colour with darker shoulders, free from ribbing and ripens to a bright red.

Plate 58.

A SINGLE PLANT OF THE VARIETY VALIANT AT THE TIME OF SETTING OF THE FIRST FRUIT, SHOWING THE COMPACT HABIT OF GROWTH.

Q2 is a mid-season variety, which is ready for picking 11 weeks after transplanting and crops for a further seven weeks. It yields heavily even under relatively hard conditions and the fruit, though large, seldom cracks during growth and carries well to distant markets. Good crops have been grown in districts other than Stanthorpe.

Q.3.

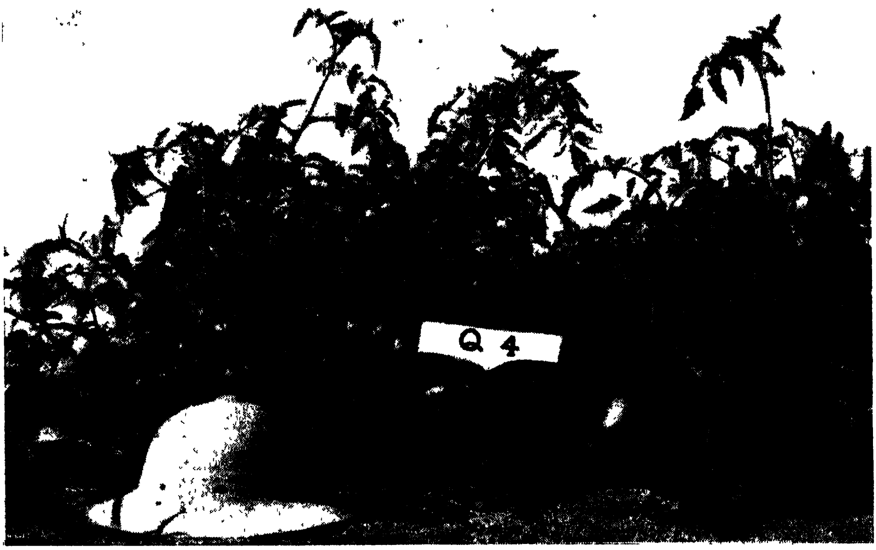
Derived from Valiant, which was introduced from the United States of America in 1936; its pedigree is somewhat obscure.

The vine is vigorous, erect, compact, determinate and densely covered with long, broad leaves which are rather dark in colour and of the normal tomato type (Plate 58). The mature fruit (Plate 60) is deep green in colour, with dark green shoulders. It is deep-globe shaped, very smooth, with a shallow stem-end cavity. The fruit is very resistant to sunburn and cracking. It develops a bright red colour when ripe.

Q3 is a late variety, which is ready to harvest approximately 13 weeks after transplanting. It yields very well and produces good quality fruit which holds its condition well in transit to market.

Q4.

Derived from the variety Rutgers, which was introduced into Australia in 1934 from the New Jersey Agricultural Experiment Station, where it was selected from the progeny of a cross between Marglobe and J.T.D.

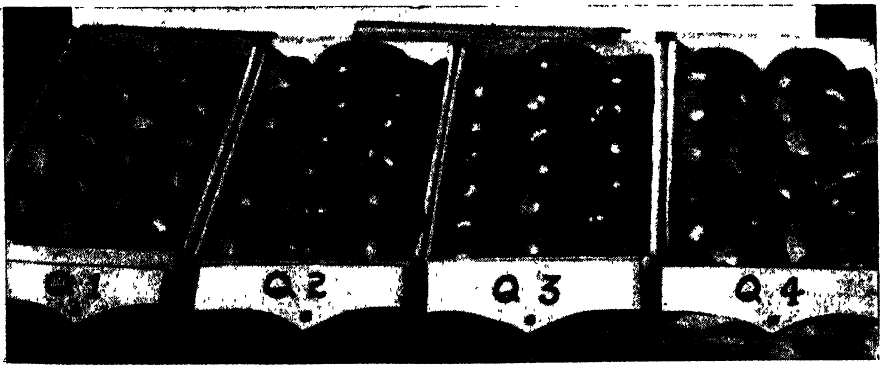


[Photograph by S. H. Mitchell.

Plate 59.

A TYPICAL PLANT OF VARIETY Q4 (DERIVED FROM RUTGERS).—Note the erect habit of growth and the dense foliage.

This variety has a large, dense, erect, non-determinate vine with leaves which are long, broad and rather dark in colour (Plate 59). The fruit (Plate 60) is large and deep-globe shaped, with smooth shoulders and shallow stem-end cavity with a medium-sized corky ring. The stylar scar is very small and smooth; cracking and sunburn blemishes are rare. The mature fruit is bright green in colour, with darker shoulders, and ripens to a bright red.



[Photograph by S. H. Mitchell.

Plate 60.

FRUIT EXHIBITED BY GROWERS OF CERTIFIED TOMATO SEED AT THE 1949 STANTHORPE SHOW.

Q4 matures late and is ready to pick 13 weeks after transplanting. It yields good crops consistently even under unfavourable climatic conditions. The fruit carries reasonably well. The parent variety Rutgers has been popular throughout the State for many years and the improved strain now available is a great deal better than related commercial lines.

Yields from Certified Seed.

The use of certified seed should pay dividends to growers by increasing yields and improving fruit quality. The four certified varieties (Q1, Q2, Q3, Q4) now available have consistently produced from 800 to 1,200 half-bushel cases per acre under Stanthorpe conditions. Recent reports show that similar high yields can be obtained in some other districts.

Distribution of Certified Seed.

The certified seed produced from registered crops and packaged under supervision is the property of the grower, who makes his own arrangements for selling it. Supplies can be purchased direct from the grower himself or through distributors appointed by him. The amount of seed produced annually depends largely on seasonal conditions and the growers' estimate of the probable demand. The latter, of course, determines to some extent the amount of fruit reserved for seed extraction on the farm before the balance of the crop is picked for the fresh fruit market.

CERTIFIED TOMATO SEED—1949.

Under "*The Seeds Acts*, 1937 *to* 1941," four varieties of tomato were approved for certification during the 1948-49 season. Certified crops were produced by the following growers, to whom inquiries for seed may be addressed:—

Grower.	Address.	Variety.
E. F. Wain	Bapaume	Q1
Harslett Bros.	Amiens	Q2
C. Couchman	Glen Aplin	Q3
E. F. Wain	Bapaume	Q4

AGRICULTURAL TALKS.

In the A.B.C. Country Hour session, heard from 4QG and regional stations on week days, talks are given by officers of the Department of Agriculture and Stock at 12.59 on Tuesdays.

Talks scheduled for September and October include the following:—

6th September.—Bees and their diseases: C. R. Roff (Apiaries Inspector).

13th September.—Pig carcass appraisal and its relationship to breeding and feeding: E. Melville (Senior Adviser in Pig Raising).

20th September.—Why milk is pasteurised: V. R. Smythe (Dairy Technologist).

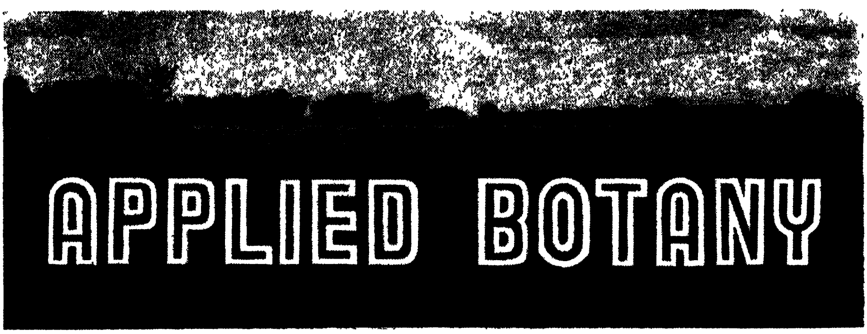
27th September.—Irrigation in the sugar industry: N. J. King (Director of Sugar Experiment Stations).

11th October.—Some aspects of milk and cream improvement: W. A. G. Haylett (Senior Adviser in Dairying).

18th October.—Sunflower growing for seed: J. Hart (Adviser in Agriculture).

WILD FLOWERS PROTECTED.

For the purpose of preventing the indiscriminate picking of wild flowers, an Order in Council has been issued protecting boronia, Christmas bells, and vanilla lily for an unlimited period. It is an offence to pick these native plants on any Crown land, State Forest, or National Park; on any public park, reserve, or road; or on any private land without having first obtained the permission of the owner or lessee of such land.



Wild Cottons—Declared Noxious Weeds.

C. T. WHITE, Government Botanist.

TWO kinds of wild cotton (*Asclepias fruticosa* and *Asclepias physocarpa*) have recently been declared noxious throughout the State, and the following notes and illustrations have been prepared to enable farmers, pastoralists, and local authority officers to recognise the plants should either or both make an appearance in their district.

The two kinds are very similar, but apart from minor floral characters can be distinguished as follows:—

A. fruticosa: Seed pods bladdery, 2-3 inches long, more or less egg-shaped and tapering into a beak at the apex.

A. physocarpa: Seed pods bladdery, more or less globe-shaped, about 2 inches in diameter, apex blunt.

Description.

For all practical purposes the two plants are so much alike in general appearance that they may be described together as follows:—

Erect shrub-like weeds, all parts exuding a milky sap when cut; bark green, very fibrous. Leaves narrow, 2-6 inches long and tapering at both ends. Flowers white, in clusters (umbels) of 5-10 in the leaf-axils; the cluster itself on a stalk of about 1 inch and the individual flowers on more slender somewhat shorter stalks. Seed pods bladdery, about 2 inches in diameter, and with soft bristles. Seeds dark brown, numerous, and each with a tuft of hairs at the top which enable them to be distributed by the wind.

Distribution.

These plants are natives of South Africa but are now widely spread as weeds in many warm countries. They were probably introduced as garden subjects and are still occasionally seen in gardens, mainly as a curiosity, though individual bushes are rather attractive.

Common Names.

The plants are mostly simply known as wild cotton or cotton bushes, sometimes as white cotton to distinguish them from the allied red-flowered cotton (*Asclepias curassavica*), a moderately common though not very aggressive weed. The names Cape cotton and balloon cotton are also given to them.

Plate 61.
WILD COTTONS—Left, *Asclepias fruticosa;* right, *Asclepias physocarpa.*

Poisonous Properties.

They belong to a dangerous family—the Asclepiadaceae or milkwort family—many members of which are known to be poisonous. In most of them the poisonous principle is a cardiac glycoside—that is, a poison having a strong action on the heart. Feeding tests at the Animal Health Station, Yeerongpilly, have shown them to be poisonous to cattle. Fortunately, the plants are distasteful and are only eaten in sufficient quantities to cause trouble when animals are driven on to them in the absence of other fodders.

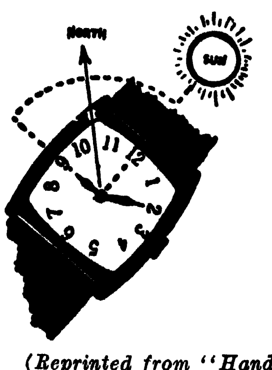
Useful Properties.

The question is often asked if the down or silk-cotton surrounding the seeds has any commercial value. It is of no use for textile purposes, the fibre being too short and brittle, and could only be used in the same way as kapok. During the war a good deal of this "silk-cotton" was collected from allied species in the United States by school children and used as a kapok substitute for army goods. Its commercial collection for this purpose is hardly likely to be a payable propositoin. The bark contains a strong fibre which might have some use commercially, but at the present time there is no market for it. During the war the plant was tried for the extraction of rubber but was not a success.

Eradication.

Where wild cotton occurs in pastures the only practical means of control is to dig the plants out or cut them off well below the surface of the ground. Hormone-type weedkillers so far tested against wild cotton have not given satisfactory results, and arsenicals, as well as being dangerous to grazing stock, are not entirely effective.

FINDING DIRECTION IN THE DAYTIME.



Provided meticulous accuracy is not necessary and one merely desires to obtain a general idea as to direction, a simple but very effective way of ascertaining the north is to hold a watch horizontally in front of one and then turn it so that the numerals denoting 12 o'clock are pointing directly at the sun.

North will be found by the direction indicated if an imaginary line be drawn from the centre of the watch to midway between 12 o'clock and the hour hand whilst the watch is being held in the position given in the sketch.

(Reprinted from "Handy Farm and Home Devices, and How to Make Them," on sale on behalf of the War Blinded Association.)

PLANT PROTECTION

Tomato Diseases and Their Control.

J. E. C. ABERDEEN (formerly Pathologist, Science Branch).

(*Continued from page 91 of August issue.*)

GENERAL NOTES ON CONTROL MEASURES.

CONTROL measures in general are discussed in the following paragraphs under the headings of selection and treatment of the seed, selection and management of the seed-bed, comparison of sprays and dusts, comparison of fungicidal materials available, crop sanitation, and spraying and dusting programme.

Selection and Treatment of the Seed.

The most important diseases which are frequently carried on or in the seed are bacterial canker and bacterial spot and certain of the virus diseases. Other important diseases which may be disseminated in this way but which are not so likely to contaminate the seed are Fusarium wilt, bacterial wilt, and target spot.

The selection of seed from disease-free plants is one of the means of combating virus diseases and is also the most efficient manner in which to eliminate the fungous and bacterial diseases of tomatoes. In view of this fact growers are strongly urged to select their own seed. This should be done while the fruit is still on the plants so as to ensure that only healthy plants will be chosen as a source of the seed supply. The fruit is left to ripen naturally on these selected plants before it is harvested for seed production. A further selection may then be made, special attention being given to the fruit type and to the health of the plant. A plant showing any symptoms of a virus disease—no matter how slight—should not be used for seed production even though the fruit may appear unblemished.

Should the grower purchase seed and there be any doubts as to its source it should be disinfected with corrosive sublimate in the following manner:—The tomato seed is placed in a piece of mosquito netting and suspended for five minutes in a solution of corrosive sublimate (mercuric chloride) used at a strength of one part of the chemical in 3,000 parts of water. The seed mass is stirred occasionally with a wooden stick during the period of suspension in order to remove any air bubbles which may be present. After immersion it is thoroughly washed in four or five changes of water, dried, and then sown immediately. Corrosive sublimate tablets, with directions for the preparation of the solution, may be obtained from a chemist.

Commercial products which may be used in the form of a dust for tomato seed treatments are those containing copper and mercury. Copper oxychloride may be used at the rate of 1 level teaspoonful to 1 lb. of seed and the mercurials at ¼ to ½ level teaspoonful. The mercury seed dust that has found most favour overseas is the one containing ethyl mercury phosphate.

It should be realised, of course, that these treatments will not protect the seedlings from disease which may attack them after they have developed.

Selection and Management of the Seed-bed.

The following diseases may occur in a tomato seed-bed sown with healthy seeds:—Irish blight, target spot, Septoria leaf spot, bacterial wilt, Fusarium wilt, bacterial spot, damping-off, and possibly the virus troubles. Care in the management of the seed-bed is accordingly essential, for in the seed-bed the whole crop is concentrated into a small area and the rapid spread of disease is facilitated. Loss of seedlings through such disease incidence often results in a delay of several weeks in planting out, with a consequential failure to gain the advantages of an early market.

Tomato seedling disease control may be exercised at four stages in the production of the young plants:—

(1) The selected seed-bed site should be well away from ornamental gardens as well as from tomato crops, and all weeds should be cleared from the site prior to sowing the seed.

(2) The seed-bed may need to be sterilized and the seed disinfected.

(3) At the time of sowing the seed should be sown in rows instead of being broadcast.

(4) After their emergence the seedlings should be sprayed or dusted with a suitable fungicide.

The placing of the seed-bed on new land is usually sufficient protection against soil-borne troubles other than nematodes, but if there is any doubt about this point the seed-bed should be sterilized by fire or by using formalin. If the heat method is employed brushwood or branches should be laid evenly over the seed-bed and the surrounding margin, the quantity of wood required being the equivalent of a solid layer about 3 inches thick. The soil should be moist but not excessively wet when the firing of the brushwood and branches takes place. When wood is readily available the heat treatment is the cheaper method of sterilizing the seed-bed soil.

If the formalin method is employed allowance should be made for the fact that the seed cannot be sown until some 12 to 14 days after the formalin has been applied. The seed-bed in this case is prepared ready for sowing, and the soil should preferably be moist but not wet when treated with the formalin. In the case of a dry soil a 1 per cent. solution of formalin (1 gallon of commercial formalin in 100 gallons of solution) is used, and it is applied with a watering can at the rate of 10 gallons to the square yard. If the soil is moist a 2 per cent. solution of formalin is watered on at the rate of not less than 5 gallons to the square yard. This amount of liquid per square yard is difficult to apply. It will be necessary to apply the liquid a portion at a time in just sufficient quantities to soak the soil, which should be loosened by a fork before each application. Alternatively, the borders of the seed-bed can be built up to form a miniature dam and all the liquid poured on in one application.

As soon as it is treated the seed-bed is covered with sacking for two or three days in order to keep in the fumes. It is then aired for a further 10 days or until the odour of formalin can no longer be detected, after which it is ready for use.

Growing conditions in the seed-bed include many factors, the more obvious of which—such as soil tilth and sufficiency of plant-foods—are well known to growers. One point which is worthy of consideration here, however, is whether the seed should be broadcast or sown in rows; the verdict in this case is that the latter method is definitely preferable in so far as disease control is concerned. A distance of about 6 inches between the rows allows easy penetration of the spray or dust to the stems and also prevents the formation of a still, humid atmosphere beneath the leaf canopy, such as is found when the seed is broadcast.

Regular spraying or dusting with a copper compound is necessary in the seed-bed, and, if spraying is preferred, Bordeaux mixture at the 2–2–40 strength, home-made cuprous oxide at the 1 to 19 strength, or commercial copper sprays at equivalent strengths, may be used. Care should be taken not to spray the seedlings too heavily, as an accumulation of spray liquid in the centre of the plants may result in burning of the young foliage. Should the grower's preference be for dusts, then any one of the proprietary copper dusts may be used. Heavy applications of these dusts should not be made on seedlings if much free moisture is present on the young plants, especially if warm weather is likely to follow dusting. Under such conditions burning may result with any of the dusts.

Comparison of Sprays and Dusts.

In the recommendations for the control of certain of the tomato diseases copper sprays and dusts have been mentioned, but no details have been given with respect to their use and comparative efficiency. These details will be discussed now under several headings.

Relative Efficiency.

Assuming that the materials being used in the spray and dusts are equal in respect of fineness of division and chemical make-up, the efficiency of a treatment depends considerably on the durability of the protective cover. In this respect sprays have the advantage over dusts. Dusts have come into greatest prominence in vegetable treatments where applications are made regularly and frequently. Even under these conditions, when the poorer durability of the dust cover is counterbalanced by the frequency of application, the spray treatment is still the more efficient when conditions are very favourable to the disease. This difference in efficiency is more marked in the control of target spot than of Irish blight, as the latter disease appears to be very susceptible to the effect of copper fungicides.

Relative Costs of Materials and Applications.

Fungicidal materials are definitely more expensive to purchase as dusts than as spray materials. On the other hand, the dusts can be applied much more rapidly and require less time for refilling the machines. Thus the cost of the extra labour for the sprays counteracts the extra expense of the materials as dusts. This is illustrated by the following data, which compare a hand rotary type duster with a knapsack spray, these being the two commercial means of application for the small grower. Values are based on those current at the time of writing.

If the fungicide is purchased as a ready mixed proprietary dust each pound of metallic copper costs approximately 5s. 2½d. Taking the cheapest spray—home-made Bordeaux mixture—the cost of each pound of metallic copper in the mixture of 4–2–40 strength is approximately 2s. 7½d. Assuming the rate of application of spray to be 240 gallons per acre, it takes 20 man-hours to treat the acre—that is, four knapsacks are applied per man-hour. This is equal to 6 lb. of copper per acre.

An equal quantity of copper in the form of a dust would be 60 lb. of a 10 per cent. copper dust, which could be applied in approximately 8 man-hours. On this basis, dusting is cheaper than spraying if labour is worth more than 10s. per man per 8-hour day.

In general, a dust is applied more frequently and at a lighter rate of application of copper per acre than a spray. For the purpose of a further comparison it is now assumed that the dust is applied four times for every three times the spray is used, but the same total amount of copper is applied per acre. It now becomes cheaper to dust if the labourer is to receive more than 16s. per 8-hour day. Many growers would calculate the results to be more in favour of dusting than the above because of the tendency towards rapid, relatively light applications of dusts. If a proprietary spray material is used instead of home-made Bordeaux mixture the comparison is more in favour of the dust treatment.

It is considered that a power spray, with its more economical use of the spray and more rapid application, is probably cheaper than hand-dusters.

Fruit harvested from dusted plants is always easier to clean than that from sprayed bushes. No definite comparisons are available here, but the saving in labour favouring dust treatment is quite appreciable.

Influence of Special Circumstances.

Dusting is favoured on the following occasions:—

(1) When there is an absence of suitable water supply for spraying.

(2) If the terrain is unsuitable for the relatively heavier gear required for spraying.

(3) Where rapid emergency treatments are required—for example, immediately before rain or between spells of rain when the ground is not sufficiently dry to take the heavier spray apparatus.

On the other hand, wind is definitely disadvantageous to dusts. Even in districts where dusts are widely used the ideal periods are usually only at dawn and dusk. In areas subject to prevailing high winds growers may be forced to use sprays.

Comparison of Materials Available.

Among the sprays commonly used for the control of tomato diseases are two home-made mixtures—Bordeaux and cuprous oxide—as well as several commercial products manufactured especially for spraying purposes and containing basic copper sulphate and copper oxychloride. All these materials exert some, often very slight, harmful effect on the plants to which they are applied, and the relative importance of this has to be considered when discussing their merits as a fungicide. While Bordeaux mixture is superior to the commercial products in respect of the actual control of the various diseases, it is inferior in that it reduces the yield of fruit to a greater extent than does any one of the others. The home-made cuprous oxide suffers from a slight disadvantage in that owing to its colour it is difficult to check the thoroughness with which the spray is being applied, although this is largely overcome if arsenate of lead is included in the mixture. The preparation of cuprous oxide mixture also requires the exercise of special care. The commercial copper sprays are easier to prepare than Bordeaux mixture, and usually reduce yields to a smaller extent.

Taking the various factors into consideration, the small grower will probably find it more convenient to use a commercial product, preferably a copper oxychloride. With a large quantity of spray being handled it is less trouble to prepare a home-made mixture, and such a spray may then be more economical and efficient to use and also more convenient generally.

Two types of copper dusts are available, one of which contains a neutral copper compound (either carbonate or oxychloride) with a kaolin filler and the other dehydrated copper sulphate with hydrated lime as a filler. They appear equally efficient in controlling Irish blight, but the copper sulphate dust may be slightly superior to the other in controlling target spot. The neutral copper compound, however, has a less detrimental effect on the total yield of fruit, which more than compensates for a slight reduction in efficiency in target spot control.

These proprietary sprays and dusts have increased considerably in popularity over the last 10 years. A number of factors have influenced this increased use, but the main one is undoubtedly the improved quality of these products; a second factor is the irregularity of supplies of materials for home-made mixtures during the war years and subsequently. As the commercial products vary in their composition, it is very difficult for any individual grower to readily judge the merits of a particular brand, and the position can be best summarised as follows. While the best products are sufficiently efficient for most circumstances, it is doubtful if any of them can control a disease such as target spot on tomatoes as well as Bordeaux mixture, and others of them are definitely inferior. The best course for the grower who wishes to use proprietary lines is to use only those which have been proved suitable, either by departmental experiments or by wide usage by other farmers.

Another point in the use of proprietary copper fungicides is that recommended rates of mixing with water are sometimes weaker in strength of copper than the Bordeaux mixtures recommended for the same purpose by the Department. Within certain limits this will not make a material difference on a rapidly growing crop like tomatoes, which is sprayed often, providing the application is thoroughly done.

TABLE 2.

TABLE OF COPPER EQUIVALENTS.

Equivalent Strength of Home-made Bordeaux Mixture required.	Weight of Commercial Spray Material to add to 40 Gallons of Water.		Weight of Dusts containing same Amount of Copper as 40 Gallons of Spray.	
	When Containing 50 Per Cent. Copper.	When Containing 12½ Per Cent. Copper.	When Containing 7 Per Cent. Copper.	When Containing 10 Per Cent. Copper.
	Lb.	Lb.	Lb.	Lb.
6-4-40..	3	12	21½	15
4-2-40 or 4-4-40	2	8	14¼	10
2-2-40..	1	4	7⅛	5

Table 2 has been drawn up to show the amount of dilution of the various commercial products required to obtain a copper content equal to standard Bordeaux mixture. Copper dusts have also been included, as the general tendency is for growers to apply them at a much lighter rate of copper per acre than for sprays.

The following figures should be of some assistance to new growers in determining the quantities of sprays or dusts required to treat a crop. For 1,000 plants 2 or 3 feet across, 20 lb. of dust or 100 gallons of spray.

should be sufficient for each application. As the plants increase in size the figures will rise to about 40 lb. of dust and about 150 gallons of spray. However, there is a considerable degree of variation in the quantities used by individual growers, and a knapsack normally uses more gallons of spray per acre than a power spray. As general practices stand at present, less copper is applied per acre per application when a crop is dusted than when it is sprayed, but the available evidence indicates that this reduced quantity is still sufficient to control average outbreaks of disease, although special care must be taken at critical periods. One important point in this connection, of course, is the fact that dusts are usually applied more frequently than sprays, and the total amount of copper applied throughout the growth of the crop may be approximately the same for the two methods of application.

Crop Sanitation.

The destruction of the residue of a tomato crop after harvesting has been completed is a disease control precaution which is all too frequently ignored. This is unfortunate because the prompt destruction of the crop residue is a valuable control measure in the case of all diseases and is particularly important for the control of Fusarium wilt, Verticillium wilt, bacterial wilt, bacterial spot, and target spot.

Spraying and Dusting Programme for Disease and Pest Control.

With every tomato crop grown there is usually an infestation of various insect pests the control of which generally entails the use of certain dusts and sprays, and for economy of labour and materials these may be combined with fungicides in the one application, both in the seed-bed and in the field. The remaining paragraphs in this article discuss suitable combinations of fungicides and insecticides.

In the seed-bed, light but frequent applications of a dust containing arsenate of lead 5 parts, sulphur 6 parts, copper carbonate or oxychloride 3 parts, and filler 6 parts by weight will ensure seedling growth free from most pests and diseases. A proprietary dust of this kind would carry the following analysis:—7.75 per cent. arsenic pentoxide (As_2O_5) as arsenate of lead, 30 per cent. sulphur as ground (or precipitated or sublimed) sulphur, 7.5 per cent. copper (Cu) as copper carbonate or oxychloride. A combination spray consisting of the 2–2–40 strength of Bordeaux mixture (or 1 in 20 home-made cuprous oxide mixture) with colloidal sulphur (1 lb. to 50 gallons) and arsenate of lead (1 lb. to 50 gallons) will achieve the same purpose. If aphids appear they should be treated with a 3 per cent. nicotine dust or nicotine sulphate spray (½ pint nicotine sulphate, 2 lb. soap, and 50 gallons of water). Insecticides containing hexaethyl tetraphosphate (HETP), such as Hexone, should not be used on tomatoes.

In the field an all-purpose dust mixture should contain arsenate of lead 10 parts, sulphur 6 parts, and copper carbonate or oxychloride 4 parts. Such a proprietary dust would carry the following analysis:—15.5 per cent. arsenic pentoxide (As_2O_5) as arsenate of lead, 30 per cent. sulphur as ground (or precipitated or sublimed) sulphur, 10 per cent. copper as copper carbonate or oxychloride. If desired, a combination spray of the 4–4–40 strength of Bordeaux mixture (or 1 in 10 home-made cuprous oxide mixture), to which 1½-3 lb. of arsenate of lead and 1 lb. of colloidal sulphur are added to each 50 gallons of the spray, may be used. A nicotine dust or nicotine sulphate spray mixture similar to that used in the seed-bed should be applied if aphids become numerous. As a general guide, treatment in the field should commence when flowering begins and continue at approximately 7–10 day intervals at least until picking tallies are at their maximum. Such a

schedule, in addition to dealing with other pests and diseases, should give a reasonable measure of control of the corn ear worm.

DDT has now been proved to be a very efficient substitute for lead arsenate and further departmental recommendations incorporating this insecticide may be summarised as follows:—

(1) For general use, apply fortnightly a treatment of a DDT-sulphur-copper oxychloride spray. It should contain 2 lb. of 50 per cent. water-dispersible DDT powder, 2 lb. wettable sulphur, and 2½ lb. copper oxychloride to 50 gallons of water. If weather conditions are such as require more frequent application of copper for fungus and bacterial diseases, the above treatment can be interspersed by a copper plus sulphur spray, as it is unnecessary to use DDT more frequently than once a fortnight.

(2) If a dust is required where corn ear worm and leaf-eating looper are the major pests, apply a standard combination lead arsenate-sulphur-copper carbonate dust at seven-day intervals. It should contain 5 parts of lead arsenate, 3 parts of sulphur, and 2 parts of copper carbonate. An occasional extra treatment will improve this schedule.

(3) If a dust is required in districts where jassids and mites are prevalent apply a DDT-sulphur dust (containing 2 per cent. DDT and 30 per cent. sulphur) at fortnightly intervals, with application of a copper dust (containing 7-10 per cent. copper) seven days after each DDT treatment.

Mixed dusts containing insecticides and fungicides in similar proportions to those stated in the recommended formulae are prepared by several firms. Although mixing on the farm cheapens the cost, it is preferable for the grower to purchase dust mixtures already prepared unless he has facilities for accurately weighing the ingredients and thoroughly mixing them.

Marketed tomatoes must not carry arsenical deposits in excess of 0.01 grains of arsenic trioxide per lb. of fruit. Ordinarily, the grower wipes his fruit to remove dirt and stains before marketing, but this procedure is not particularly efficient in removing spray and dust residues which tend to lodge in cracks and furrows on the surface of the fruit.

Chemical treatment is much more efficient and is therefore sometimes adopted. The method entails the use of first an acid solution and then an alkaline solution for neutralising any acid left on the fruit. The acid dip consists of 1 quart of commercial hydrochloric acid mixed with 25 gallons of water. The alkaline dip is made by adding ¾ lb. of hydrated lime to 25 gallons of water. The container used to hold the solutions should be large enough to allow easy manipulation of a suitable wooden case within them and should be equipped with inclined draining boards. The tomatoes are placed in the wooden case—which should have the boards spaced sufficiently far apart to allow rapid penetration of the solution and quick drainage—and are immersed in the acid dip for 1½ minutes, the case being moved up and down in order to wet all the fruit. The case is withdrawn at the end of the acid dipping period, is allowed to drain on the draining boards for a few minutes, and is then plunged into the lime dip for 1 minute. After removal from this dip the tomatoes are again drained, well sluiced with clean water, and set aside to dry thoroughly before packing.

Twenty-five gallons of the acid dip is sufficient quantity to treat at least 35 bushels of tomatoes carrying heavy spray residues. Sound and scarred tomatoes, whether coloured or green, are not injured by this treatment, nor is cracked fruit affected provided it is dried quickly after the dipping process.

Yellow Crinkle Disease of Papaws.

Provisional Control Measures.

T. McKNIGHT, Pathologist, Science Branch.

EVERY year the destructive virus disease "yellow crinkle" reduces the papaw yield of the State. In epidemic years it causes heavy losses in yield, but, what is more important, it produces ragged plantations with a marked reduction in the number of trees per acre, the effect of which persists over the whole of the bearing life of the plantation. Disease hazards in papaw culture are great, and the "yellow crinkle" virus must not be allowed to exact an early toll from the new planting.

Plantation owners are familiar with the fact that virus diseases are particularly hard to combat. The investigations on this disease are not complete, but the following notes will acquaint growers with some of the information available and will be of assistance in the establishment of bearing crinkle-free plantings with the required number of trees per acre at the end of the first 14 months.

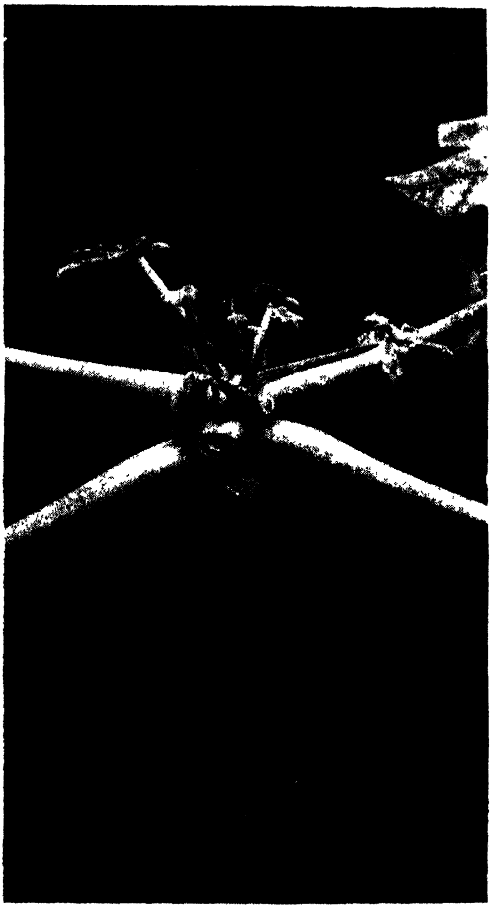


Plate 62.

AFFECTED TERMINAL, SHOWING DWARFED CROWN LEAVES.

Symptoms of the Disease.

Yellow crinkle appears in the early summer months, and by January of any year is of common occurrence in papaw plantations throughout the State. While the incidence of the disease varies appreciably in different localities of any one district, losses of the order of 10 per cent. commonly occur in young plantings in south-eastern Queensland, while in central and northern plantations losses up to 30 per cent. are recorded in years when the virus is particularly active.

The symptoms of the disease are accordingly well known to growers. The first signs of infection are the appearance in one or two of the mid-crown leaves near the leaf margins of translucent or "cleared" areas between the leaf veins and the yellowing of the older leaves, the stalks of which bend down slightly where they join the trunk. At this stage the youngest leaves are normal, but in a short time terminal growth ceases, the young crown leaves become yellow, the margins curl under, and the leaf blade is much reduced in size, being generally not much wider than the leaf stalk (Plate 62). By this time the cleared areas between the veins in the first infected leaves have dropped out to produce a very conspicuous, narrow, irregularly shaped leaf, with injury resembling grasshopper damage. The petals and other flower parts on diseased trees are replaced by coarse, frequently enlarged, leaflike structures (Plate 63), and in the final stage the tree is reduced to a trunk devoid of foliage and with a cluster of small leaves at the top.

Plate 63.
LEAF-LIKE FLOWERS FROM A YELLOW CRINKLE-INFECTED PLANT.

Some Features of the Disease.

A common misunderstanding among growers is that cutting back the trunk to remove the diseased terminal, or cutting off an affected side branch, depending on where the disease first appears, is a worthwhile measure which may prevent the subsequent spread of the disease throughout the plant. Field investigations, however, have shown that when one part of the plant becomes infected all other parts ultimately contract the disease. In the first instance the main trunk or one of the side shoots may exhibit symptoms (Plate 64) and, despite removal of the infected part, spread into the other parts occurs in most cases

by the following summer and no marketable fruit are obtained. In an established plantation the appearance of the disease in any part of the plant is the signal for cutting the plant at ground level to die.

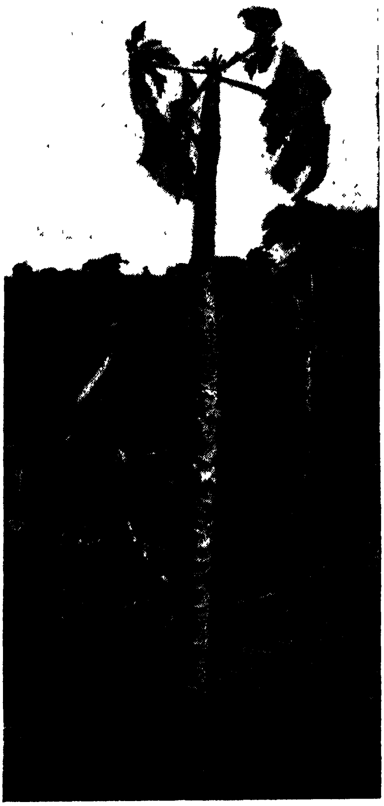


Plate 64.

AFFECTED TERMINAL WITH A TEMPORARILY HEALTHY SIDE SHOOT.

Unlike a number of other viruses, yellow crinkle virus is not mechanically transmitted. There is, therefore, no likelihood of transferring the disease from plant to plant during picking or cultural operations.

The earliest infections occur in November. The incidence of the disease reaches a peak in midsummer, and the great majority of the season's infections are recorded by the end of March. New infections do not occur during the cooler months, and the period for further infections commences in the following November.

Generally a much higher percentage of infections occurs in young plantings than in older trees.

The diseased trees generally occur at random throughout a plantation, although occasionally irregular groups of diseased trees may appear. In the first summer, in multiple plantings more than one plant per position may become infected, but this is relatively uncommon.

It has been noted that over the period when yellow crinkle disease appears in papaws many common weeds and some cultivated plants growing in and adjacent to plantations in south-eastern, central, and northern districts are infected with tomato big-bud virus disease. It is probable that this virus is identical with the virus causing crinkle in papaw.

It is possible that most of the infection with yellow crinkle arises from other species of plants in and around the plantation and is carried to the papaw by an insect. The suggestion is made that the spread of the disease from papaw to papaw is not as important as the spread from outside sources into the papaw.

The virus is consistently appearing in plantations, but in some years it is epidemic—as in 1936, 1939, and 1948. There is no reason why this virus cannot become a still greater hazard to papaw culture.

Control.

Work now in progress should lead to more definite recommendations for the control of this disease. In the meantime it is suggested that growers give some thought to the following suggestions.

To defeat this disease in young plantations, growers will have to maintain more plants per acre for the first 12 months—that is, until the first yellow crinkle season has passed, This must be achieved, naturally, in a manner that will not entail heavy competition between individual trees in the young plantation and in such a way that a reserve of trees will be maintained until the end of March or early April.

This can best be accomplished in conjunction with the desirable fairly late plantings, such as late February or early March in south-eastern Queensland, which will produce plants of relatively small stature flowering about November.

In plantations where the multiple planting system is adopted three plants are established in each position to permit the culling of unwanted males and to allow some individual selection for vigour and type. This culling, carried out in November, will coincide with the period for the appearance of the first yellow crinkle infections so that at this time the routine removal of yellow crinkle infected trees should commence also. Unwanted healthy companion trees in each position should be cut back and not cut out in order to provide a reserve of trees to compensate for further yellow crinkle infections developing during the period November-April.

In November, therefore:—

(1) All diseased trees will be cut out at ground level.

(2) The surplus companion tree, or two companion trees, as the case may be, in each position, will be cut back to either 1 or 2 feet above ground level. In order subsequently to differentiate between male and female trees, male trees could be cut back to a foot above ground level and female trees to 2 feet above ground level.

(3) One healthy, unpruned tree will remain in each position.

The cut-back companion trees in each position will subsequently produce side shoots which can be rubbed off as they appear or allowed to develop if the original tree should become diseased. On monthly inspections until early April, therefore, a routine should be adopted for cutting to the ground all virus infected plants and maintaining one healthy plant per position, either by (*a*) the continued growth of the original plant left in November, or by (*b*) cutting the original plant to the ground if infection occurs and permitting the side shoots from one of the cut-back companion trees to develop.

In early April all surplus cut-back companion plants should be removed by cutting to ground level.

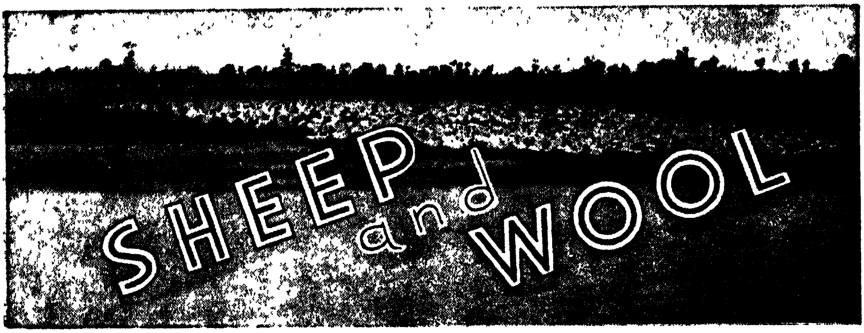
Alternatively, to have this reserve of trees to cope with losses from the virus, some growers may prefer to plant out an additional seedling between every tree position either at the same time or a few weeks after the original seedlings are established. At the time of thinning out of the trees in position the reserve trees will be cut back, and they will either be maintained or cut out later, depending on the disease incidence.

A similar plan may be adopted in plantations where the multiple planting method is not practised but where seedlings are planted a few feet apart in the row and a close density of plants per row is maintained until the thinning out of excess trees at flowering. In this case between 10 and 30 per cent. of trees at regular intervals between those left in position will be cut back instead of being cut out in November. On subsequent monthly inspections until early April all yellow crinkle infected plants will be cut to ground level and the previously cut-back trees will have the developing shoots rubbed off if the nearby trees are healthy, or allowed to develop if an adjacent tree in the row has been removed because of infection.

It is considered that this system of providing reserve cut-back trees over the period of yellow crinkle incidence should not produce a detrimental effect on the trees in position if the regular monthly routine is adopted. The cutting-back cutting-out routine could be speedily carried out with a cane knife and there would be no need to sterilize the knife during the operations. The affected trees can be left to die where they fall. The net result will be a bearing planting with the requisite density of trees per acre at the end of the first 14 months. On an average, as the trees become taller epidemic incidences of the disease become less probable. If infected trees appear the following summer they should be cut out.

Seed-beds should be isolated as far as possible from summer growing crops and from ornamentals, and as a precaution seedlings should be dusted or sprayed with DDT at intervals of a week or 10 days.

Many weed species are suspected of carrying the yellow crinkle virus, so that in plantations on level country good weed control in and around the plantation should be maintained over the period November-March. On hillside plantations it is neither practicable nor desirable to keep the plantation free from weeds over the period of the summer rains, and in both types of area the accent is placed on the cutting-back cutting-out procedure.



Mastitis in Ewes.

G. R. MOULE (Officer in Charge, Sheep and Wool Branch), G. C. SIMMONS (Assistant Bacteriologist, Animal Health Station, Yeerongpilly), and H. POPE (Senior Adviser in Sheep and Wool).

MASTITIS, or mammitis, as it is sometimes called, is a condition in which there is inflammation of the udder. It is not commonly seen in ewes kept under pastoral conditions, but the recent occurrence of gangrenous mastitis in two flocks in the Maranoa focussed attention on the quite heavy losses which can occur when ewes with lambs at foot are affected.

The Cause of Mastitis.

Mastitis is caused by bacterial infection establishing itself within the udder. This usually occurs after the invading organisms have ascended the teat canal, though they may gain entrance through a wound. Several types of organisms may cause mastitis, the one most commonly occurring being a staphylococcus.

Many conditions predispose the udder to infection. These include:—

(1) Any changes lowering the general resistance of the ewe.

(2) The milking capacity of the ewe.

(3) Mechanical injury to the udder.

(4) Frost bite, which is probably uncommon in Queensland.

(5) Sore teats, which southern observers consider are important forerunners of gangrenous mastitis.

Veterinarians investigating mastitis of ewes in Tasmania report that sore teats are relatively common in Merino ewes during their first lactation, irrespective of age. From 20 to 60 per cent. of Merino ewes lambing for the first time may be affected, and some of these subsequently develop gangrenous mastitis.

Symptoms.

Two types of mastitis occur, namely—

(1) Simple mastitis, which is usually not very serious;

(2) Gangrenous mastitis, which is serious, and may be fatal.

In simple mastitis the milk becomes clotted and the udder may be hard, swollen, and inflamed. Recovery may be complete or the affected teat may go blind. Because of its comparatively mild nature, mastitis of this type commonly escapes notice, but it can be quite important amongst crossbred mothers of fat lambs as it leads to a decreased milk supply and a reduced fattening rate. Accordingly, ewes should be examined carefully each year before joining, and animals with blind teats rejected.

Gangrenous mastitis is more severe and can be fatal. The onset is sudden and one or both halves of the udder may be involved. Attention is often first drawn to the disease by lameness in one or both hind limbs. The affected udder is hot and swollen; the skin is discoloured and painful when touched, and it characteristically changes colour, from red in the early stages to dark blue, and finally black. Milk secretion is suppressed and that from the affected half may be blood-stained. Sometimes a dark swelling extends along the belly and the wool from this area may pluck easily. The animal is depressed and disinclined to eat. Temperature is raised and the respiratory rate increased. The whole of the hindquarters may become stiff, and sometimes the udder or affected half sloughs.

Some sheep recover, but quite heavy mortalities may occur. In one of the recent outbreaks, involving a flock of 2,400 ewes, 72 died and six recovered. The ewes were affected two and a-half to four months after lambing, but reports from other States indicate that ewes are commonly affected five to seven days after lambing. Some ewes collapse suddenly and die without showing typical symptoms.

Post-mortem Findings.

The post-mortem findings are fairly typical in ewes which have died from gangrenous mastitis.

The subcutaneous tissues of the belly are usually infiltrated with sanguinous exudate, which may be black and as much as $\frac{3}{4}$-inch thick. Sometimes it extends down the inside of the back legs.

The udder is dark and contains blackish, blood-stained fluid, and the regional lymph glands are usually enlarged. Small scabs may be found around the teat orifice.

Treatment.

The recommended treatment is administration of the drugs sulphamezathine or penicillin. Sulphamezathine is sold in 0.5 gm. tablets or as a solution of sodium sulphamezathine. The tablets may be given by mouth and the dose rate is two such tablets—that is, 1 gm. per day for every 15 lb. live weight. A $33\frac{1}{3}$ per cent. solution of sodium sulphamezathine may be injected subcutaneously, and the dose rate is 3 c.c. for every 15 lb. live weight.

Alternatively, if the disease is detected early, penicillin in oil can be introduced into the udder through the teat canal after the affected half of the udder has been stripped of milk. There are several proprietary lines of penicillin in oil which are marketed for the treatment of mastitis in dairy cows, and one of these may be used.

If these drugs are not readily available, local treatment which may be used is frequent milking out of the udder and, perhaps, hot foments and gentle massage.

ANIMAL HEALTH

Cattle Tick Control: Results Achieved in the Field with DDT and BHC.

J. C. J. MAUNDER, Director of Veterinary Services.

OWING to the failure of standard arsenical dips to control ticks (*Boophilus microplus*) in many parts of Queensland, it became necessary to develop new methods. Extensive laboratory and field trials indicated that DDT and BHC (benzene hexachloride) were vastly superior to arsenic. This article gives a brief resumé of the information obtained in the field and will indicate which material is likely to give the better results under various conditions.

The name DDT is now familiar to most people; BHC stands for benzene hexachloride, the name of a substance which has a complex makeup, its active principle being called the gamma-isomer. This is the substance that is contained in those proprietary preparations with the prefix gamma.

For official dipping mixtures recognised in The Diseases in Stock Acts, dipping fluids must contain, when mixed according to the manufacturer's instructions, either—

(*a*) 8 lb. arsenic in 400 gallons of mixture; or

(*b*) 0.5 per cent. para-para-isomer of DDT; or

(*c*) 0.05 per cent. gamma-isomer of benzene hexachloride.

REQUIREMENTS OF AN EFFICIENT DIP MIXTURE.

To enable one to determine the efficiency of any given mixture the following requirements are enumerated:—

(1) Ability to kill ticks, including the arsenic-resistant tick, in all stages with an economical concentration.

(2) Non-toxicity to stock and to humans.

(3) Residual effect—that is, continues to kill larval ticks picked up subsequent to dipping.

(4) Stability in a dipping vat over a period of months.

(5) Control of other external parasites—for example, buffalo fly, bush fly, and lice.

(6) Economy.

(7) Ease of mixing and management.

DDT DIPPING MIXTURES.

At present there is only one preparation on the market that is considered to be suitable for use in a dipping vat, as it is the only one that will retain reasonable stability over a period of months. The concentrate is a thick, paste-like substance containing 50 per cent. of the para-para-isomer of DDT, and it requires heating before being added to the dip.

This preparation has been used extensively under official supervision during the past two years. The following is a brief resumé of the information obtained, grouped under the headings previously mentioned. It must be understood that the remarks apply only to this specific preparation, and not to any other DDT preparation.

Toxicity for Ticks—Concentrations to Use.

Dips are usually charged at the rate of one 56 lb. drum of the concentrate to 500 gallons of water; the concentrate contains 50 per cent. of the p.p. isomer of DDT, so the dipping mixture used contains 0.56 per cent. DDT. Subsequent topping-up should be at the same rate. In some cases dips are charged at half this strength—that is, one 56 lb. drum of concentrate to 1,000 gallons of water. Dips charged at 0.56 per cent. give a very good kill of all stages of ticks, though it cannot be expected that one dipping will kill 100 per cent. of ticks in all stages on every beast. Those most likely to escape are the engorged nymphs and the engorged female adults, and some of these will drop off and lay viable eggs. It would appear that those which drop off within a few hours of dipping are less likely to lay viable eggs than those which drop off a few days after dipping. There is no doubt that DDT at this strength is considerably superior to arsenic in the kill obtained, whether the ticks be arsenic-resistant or otherwise.

The kill is fairly slow, and takes about 10 days to reach the maximum. The majority of ticks would be killed within 5-7 days, but a few that were alive at seven days would be killed within 10 days.

The kill obtained at half-strength (0.28 per cent.) is still very good, and superior to arsenic, but is much less than at 0.56 per cent.

Non-toxicity to Stock and Humans.

There is no information available to suggest that men handling DDT dips suffer any ill-effects, and certainly DDT is much less dangerous to handle than is arsenic.

There is no doubt about the low toxicity of DDT for cattle; in fact, this is one of its greatest advantages. Travelling mobs can be treated in the heat of the day, or in humid, drizzly conditions, without suffering any ill-effects; drovers maintain that cattle seem refreshed by the dipping. Therefore, there is no danger of the scalding and mortalities that are often experienced with arsenical dippings under Queensland conditions.

Residual Effect.

This is the property of DDT that makes it such an outstanding material for control of the cattle tick. When used at 0.56 per cent., the protective period is almost absolute up to five days, which means that practically all larval (seed) ticks that are picked up within that

period will be killed. The residual effect then fades gradually; it is still good up to 10 days, and from then fades fairly rapidly and would be very slight after 14 days.

At half-strength the residual effect is correspondingly shorter.

The residual effect of DDT dipping has been utilised to protect susceptible cattle which travel through tick-infested areas. It often happens that fats from marginal country are railed to works on the coast and rest en route at spelling places that are heavily infested with pathogenic and arsenic-resistant ticks. The dipping of these fats in DDT prior to trucking enables them to spell in dangerous areas without running the risk of picking up pathogenic ticks and subsequently developing tick fever before they are killed out. This particularly applies to fats railed from north-western Queensland and destined for works in New South Wales. The residual effect of the DDT is sufficiently strong to kill any larval ticks that are picked up at the spelling places before they can infect the cattle with the tick fever organisms.

The same applies to stores from marginal country walking through infested country with an ultimate destination in clean country.

Stability in a Dipping Vat.

This is an aspect of DDT dipping mixtures which requires clarification; we do not yet know the full answer to the problem, but at least we know enough to enable the mixture to be used effectively and economically.

When a dipping vat is charged at the rate of 0.56 per cent. the concentration falls fairly rapidly and stabilises at about 0.38 per cent. Provided that cattle are going through in fair numbers and topping-up is carried out at the rate of one 56 lb. drum to 500 gallons, the dipping mixture will remain stable round the figure of 0.38 per cent. Where only a small number of cattle are dipped (say 100 head) and then the vat is allowed to remain idle for, say, three months, then the DDT concentration may be low, perhaps in the vicinity of 0.2 per cent., which still kills ticks but does not give the full residual effect.

Although dips under official supervision are analysed regularly to determine DDT content this would not be necessary for private dips used to control ticks. Simply get an analysis when the dip is first charged, continue to top-up at the rate of 1 drum to 500 gallons, and get another analysis done only if the vat has been flooded or if it has not been used for some months.

Control of Buffalo Fly, &c.

Dipping in DDT dipping mixture gives excellent kill and control of buffalo fly, the residual effect persisting for nearly a month; it is also effective against lice and bush flies. Reports coming to hand from time to time suggest that the control of bush flies has a beneficial effect on the incidence of blight. No work has been done by us to confirm these reports on blight, and they are only mentioned as a matter of interest.

Economy.

This is the point where DDT dipping loses some ground, particularly compared with arsenic. It costs approximately 10 times as much to charge a dipping vat at 0.56 per cent. DDT as it does to charge with arsenic. On the other hand it must be remembered that yarding and

mustering for dipping would cost in the vicinity of 3d. per head, the cost varying up or down according to the type of country. In many places cattle have been dipped 10 times during the year in arsenic, costing, say, 2s. 6d. per head per annum, without achieving control of cattle ticks. Those same places now dip in DDT. Not more than five, or sometimes four, dippings per year are required, costing, say, between 3s. and 3s. 6d. per head per annum, on the basis of 6d. per head for material and 3d. per head for mustering. When it is realised that buffalo fly, lice, and possibly bush flies are also controlled with no extra cost, and that there is no risk of scalding or mortalities, plus the fact that tick worry is absolutely eliminated, then the cost of DDT dipping is not so prohibitive after all. Moreover, some stock owners have obtained very good tick control with half strength mixtures—that is, one 56-lb. drum to 1,000 gallons of water.

Obviously, in areas where ticks can be controlled with arsenic by dipping, say, six times a year, and where buffalo fly is not prevalent, then it may not pay to dip in DDT.

Ease of Mixing and Management.

The only satisfactory DDT concentrate on the market that can be used in a dipping vat requires heating before adding to the water in the vat. The manufacturers' instructions should be followed carefully, when little difficulty should be experienced. As the preparation is more effective when used in soft waters, special precautions must be taken. Before a dip is charged a sample of the water to be used should be sent to the Department of Agriculture and Stock or to the manufacturers for examination. It may be found necessary to add some softener to achieve best results.

It has always been stressed that over-heating will spoil the product, but it is seldom realised that insufficient heating must also be avoided. Provided that the contents are stirred slowly during the heating and are not allowed to boil it is quite safe to continue heating until the contents are of an even, dark-brown consistency.

The management of a DDT dipping vat requires more care than an arsenic vat. For instance, as the DDT settles down from suspension very rapidly it is necessary to use about 20 head of stirrers before a mob is dipped. Otherwise the first 20 would be going through a suspension that would not contain sufficient DDT to kill ticks.

For much the same reason large sumps should be avoided and the run-off from cattle in the draining pen should go back directly into the vat. If allowed to run back through a sump much DDT settles out in the sump and therefore a weaker suspension is returned to the vat.

Sandy particles seem to take DDT out of suspension, and care must be taken to prevent cattle carrying too much dirt into the vat. This can be done by concreting the floor of the entire length of the crush and placing some "stops" across the floor of the crush to prevent the dirt being carried in.

Hair, &c., that accumulates on the surface of the dipping mixture should not be skimmed off unless absolutely necessary, as it is rich in DDT and its regular removal would weaken the mixture.

Cattle Travelling to Clean Country.

Outstanding success has been achieved with the policy of charging with DDT dips strategically placed along stock routes for the dual purpose of buffalo fly and cattle tick control. There have been quite a number of occasions on which spread of the fly has been averted by the fact that cattle had to pass through DDT dips for tick control before proceeding to clean country. In addition, the long hold-ups that often occurred through the failure of arsenic to kill ticks have now been eliminated, resulting in a large saving to the industry.

In those cases where cattle are grossly infested with ticks and have to be cleansed before proceeding to clean country, it has been found worth while to dip under supervision in DDT, dip again three days later, and then inspect seven days later—that is, 10 days after the first dipping. They are almost invariably found clean at this inspection, and they can then be dipped and proceed. This extra dipping at three days is only recommended where cattle are grossly infested.

DDT PREPARATIONS FOR SPRAYING.

A number of emulsions are on the market which are very convenient where stock have to be hand-sprayed or treated with power-sprays. These are very satisfactory when used at the strength of 1 per cent. DDT, but at stronger concentrations tend to irritate cattle a little and horses quite a lot. For best results the actual spraying mixtures should be freshly prepared each time, since if made up in any bulk and allowed to stand there is always a possibility that the emulsion will "crack," with a separation of active ingredients and loss of efficiency.

Where hand atomisers are used the concentration of DDT can be increased to 2 per cent. or even up to 4 per cent. without causing irritation; these appliances have the advantage of economy as only a fraction of the volume is required that would be used with ordinary bucket sprays. Although their use is only new and experience therefore limited it is nevertheless interesting to refer to the use of these atomisers. On dairy farms that formerly carried heavy tick and buffalo fly infestations both pests are well under control as a result of the occasional use of hand atomisers. These have been used particularly in the Cairns district on the recommendation of Mr. N. C. Copeman, District Inspector of Stock, Cairns.

The dairyman keeps his atomiser of 1-pint capacity ready-charged with 2 per cent. DDT in the bails. The milking herd is not dipped or sprayed at intervals, but he simply sprays the legs, belly, brisket, udder, and escutcheon of any cow he notices to be ticky. Not only does this result in the majority of ticks being killed, but the residual effect of the spray on the brisket, belly, legs, udder, and escutcheon destroys thousands of larval ticks picked up from the paddocks. In other words, these cows act as walking poison baits and soon reduce the tick population of a paddock to negligible proportions.

Dispersible powders are also convenient for hand-spraying, again at strength of 1 per cent. DDT. The mixture is prepared simply by adding the powder to water and stirring it; it is non-irritant and should always be freshly made up just prior to use.

BHC (BENZENE HEXACHLORIDE) DIPPING MIXTURES.

As previously explained, those preparations on the market with the prefix "gamma" have as their active principle the gamma-isomer of benzene hexachloride. At the moment there are only two preparations on the market that are used in dips for cattle tick, but there are a number of similar preparations not yet marketed here.

BHC will be dealt with under the same headings as DDT and comparisons drawn with that substance.

Toxicity for Ticks—Concentrations to Use.

The concentrate on the market is obtainable in drums of 50 lb. which contain 50 per cent. by weight of benzene hexachloride, including 6 per cent. of the gamma-isomer. To give an effective concentration of 0.05 per cent. gamma-isomer one 50-lb. drum of the concentrate is added to 500 gallons of water. Subsequent topping-up should be at the same rate.

At this concentration the BHC dipping mixture gives an excellent kill of ticks in all stages, including the arsenic-resistant tick.

Once again, however, it is too much to expect that, in heavily infested cattle, every tick will be killed on every beast at a single dipping. As with DDT the engorged nymph and the engorged female are the most likely to escape, and a proportion of these will lay viable eggs. However, more of these ticks are killed by the BHC and a lower proportion of surviving females lay viable eggs.

The kill is considerably quicker than with DDT, the majority being killed within 24 hours and the maximum kill being achieved within three days.

It can therefore be said that BHC at 0.05 per cent. gamma-isomer concentration gives a quicker kill than DDT at 0.5 per cent. para-para-isomer concentration, and probably accounts for more of the engorged females. BHC used at 0.025 per cent. gamma-isomer concentration gives a good kill of ticks and is comparable to 0.28 per cent. DDT (p.p.i.); but again gives a quicker kill.

Non-toxicity to Stock and Humans.

There is no indication that humans suffer from handling BHC, but it is probably slightly more irritant to cattle than is DDT; in any case, it is much safer to use than is arsenic.

Residual Effect.

Here, again, BHC is inferior to DDT but superior to arsenic. At the concentration of 0.05 per cent. the residual effect is quite good up to three days after dipping, but then falls rapidly and would be negligible at seven days. At 0.025 per cent. the residual effect is proportionately shorter.

Stability in Dipping Vat.

As with DDT, the concentration falls fairly rapidly from 0.05 per cent. to something in the vicinity of 0.03 per cent., but it does not stabilise at that figure quite as well as DDT. However, it is still satisfactory, and it is found that the mixture will continue to kill ticks when topping-up is carried out at the rate of one 50-lb. drum to 500

gallons water and provided that the dip is used fairly frequently. It loses considerably when allowed to remain idle for a period of, say, three months. It would appear, then, that it is slightly inferior to the DDT dipping mixture on the score of stability in a vat.

Control of Buffalo Fly, &c.

Comparatively little experimental work has been done on this aspect of BHC, but sufficient is known to state that it cannot compare with DDT in the control of buffalo fly. No information is available concerning bush flies.

Economy.

BHC dipping is slightly cheaper than DDT, but still is much more expensive than arsenic. When the greater residual effect of DDT is taken into consideration, there would probably be no difference in the cost of dipping on the basis of per head per annum whether using DDT or BHC.

When comparing DDT and BHC with arsenic it is obvious that where ticks cannot be controlled with arsenic it pays to use BHC or DDT, but where arsenic is satisfactory it may not pay to use either DDT or BHC. The number of cattle likely to pass through a given dipping vat in a season would determine to a large extent whether or not it would pay to use DDT or BHC in preference to arsenic. On a run where some hundreds at least would pass through in mobs of 100 or more, the numbers would be sufficient to justify the dearer insecticides. However, it may not pay a small dairyman to charge a dip with BHC or DDT where he would only be dipping about 30 to 40 head say six times a year.

Ease of Mixing and Management.

The BHC concentrate on the market does not require any heating before adding to the water in the vat. It is supplied as a dark paste which contains some lumps, and the contents should be stirred thoroughly until uniform in colour and until the lumps have broken down. Part of the contents is then transferred to another drum, to which cold water is added slowly, stirring thoroughly until completely mixed. This is then added to the vat and the process repeated until the whole of the contents have been mixed thoroughly and added to the vat.

Naturally, this is easier than the heating necessary with the DDT preparation, and saves a little time and trouble. It has not been found necessary to add softener to waters, and it is not necessary, though it may be advisable, to submit water samples for analysis before charging a vat with BHC.

In the management of BHC dipping vats the same precautions should be taken as described for DDT—namely, use stirrers, avoid sumps, prevent contamination of the vat with dirt taken in by cattle, do not skim the surface.

It is important with both DDT and BHC dipping mixtures to keep accurate records of the vats. Measure the depth of the mixture before and after each dipping and record the measurements so that concentrate can be added to compensate for any water that may leak into the vat between dippings. This is absolutely essential for the efficient working of the mixtures.

SAMPLING OF DIPS.

With both preparations (BHC and DDT) special precautions must be taken when collecting samples for analysis. The DDT and BHC settle down rapidly after dipping and the actual sample should be taken while the last beast is swimming through. It is preferable that the sample be submitted in the actual container in which it is taken from the vat. A satisfactory procedure is to fasten a beer bottle on to a stick, push it down to a depth of about 2 feet from the surface and about 3 feet from the plunge end, allow to fill, withdraw, cork, and send to the analyst.

THE MIXING OF ARSENIC WITH OTHER INSECTICIDES.

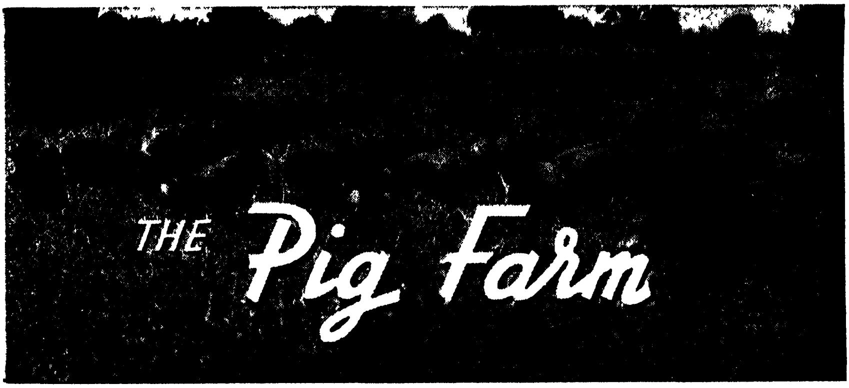
It is not wise to mix arsenic with other insecticides where dippings have to be repeated at short intervals (5-10 days). It is well known that different insecticides when mixed together seem to act as synergists—that is, they assist each other to have greater effects than either would have separately. However, just as their toxicity for cattle tick may be increased by the mixture, there is also the danger that the toxicity of arsenic for cattle may be increased, thereby increasing the possibility of arsenical poisoning occurring in dipped cattle. Therefore, until further work is done on this aspect of the problem, stock owners would be well advised to avoid mixing these insecticides with arsenical dipping mixtures.

NEWER INSECTICIDES.

In addition to DDT and BHC there are new insecticides which may prove to be valuable for the control of cattle tick. Some experimental work has been carried out with chlordane and toxaphene. Preliminary results indicate that chlordane kills as well as BHC and has a residual effect at least equal to DDT. Toxaphene has also given good results. However, neither preparation is yet available in a form suitable for use in a dipping vat, and all trials carried out have been spraying trials. It is therefore too early to make any definite recommendation on the use of these substances.

THE FUTURE OF DIPS AND SPRAYS.

The control of cattle tick in Queensland is essentially by dipping, but it must be remembered that in other countries where the cattle tick pest is a problem control is effected by the use of power sprays which deliver the spraying mixture under high pressure. In those countries dips are becoming a thing of the past, and it may well be that the future of tick control in Queensland will be bound up with the development of power sprays, which are so much cheaper to instal than dipping vats, are cheaper to operate, pass cattle through quickly, and are suitable for a greater variety of insecticides than is the case with dipping vats.



Baconer Pig Carcass Competitions, 1949.

THE Australian Meat Board, in association with the Department of Agriculture and Stock and with the co-operation of all sections of the industry, this year again conducted a Baconer Pig Carcass Competition on a district basis.

The championship was awarded to Messrs. Hastie Bros., of the Mareeba district, for a pig sired by a Canadian type Berkshire boar and with a Large White x Berkshire cross dam, with a score of 82 per cent. The carcass was of very good type, scoring well in all points, thus presenting a nicely balanced and evenly proportioned carcass well fleshed and with an even covering of good quality fat.

Prize winners in their respective districts were as follow:—

Prize.	Owner.	Breed.	Total Points.
	NORTH QUEENSLAND.		
1st	Hastie Bros.	Canadian Berkshire ex Large White Berkshire	82
2nd	W. Hastie and Son	Canadian Berkshire	79½
3rd	H. J. Williams	Canadian Berkshire ex Large White	77
	CENTRAL QUEENSLAND.		
1st	A. Lohmann	Wessex Saddleback	81½
2nd	H. C. Iker	Berkshire	78
3rd	E. G. Davey	Large White	77½
	DARLING DOWNS.		
1st	E. G. Traves	Berkshire	75½
2nd	D. J. Doig	Large White	74½
3rd	K. B. Jones	Large White	74
	SOUTH QUEENSLAND.		
1st	A. H. Ruge	Berkshire	79½
2nd	Q.A.H.S. and College	Berkshire	79
3rd	J. A. Heading	Large White	75

Generally speaking, the competitions were a success. In all 103 carcasses were judged and showed a considerable improvement on last year's entries, indicating that farmers have benefited from experience and utilised the information and knowledge gained as a result of the 1948 competitions and field days.

Arrangements were made to announce the winners of each district competition immediately after judging and this met with approval, especially the completion of the score cards, which clearly set out the points awarded and also the standard measurements of carcasses within their respective weight ranges. It is considered that the display of these cards added greatly to the interest of the field days and was of excellent educational value.

North Queensland.

At Mareeba, arrangements were made by the District Pig Adviser (Mr. T. Abell), in association with the manager of the North Queensland Bacon Association (Mr. Dunlop), for the holding of a field day at the factory, which approximately 35 farmers attended. Owing to wet weather conditions only 11 entries were available for judging. The carcasses were presented in good condition. Body length and eye muscle, the two points emphasised at the 1948 competition as needing attention, showed a marked improvement, several carcasses scoring full marks for these points and in one instance body length was exceeded by 10 mm. However, back fat was under standard in all cases except one and carcasses would have appeared better if carrying a little more fat. Ham development was fair, while the shoulders in many cases were a little heavy. These two points require the attention of breeders.

Central Queensland.

At Rockhampton the arrangements for the field day, at which approximately 160 farmers attended, were made by Mr. O. H. Brooks (Veterinary Officer) in association with Mr. B. Dunbavand (Stock Inspector) and with the co-operation of the management of the C.Q.M.E. Co. Ltd., who also provided luncheon.

A record of 59 carcasses was presented for judging. All carcasses were well prepared. The chief points revealed by the judging were the marked improvement in eye muscle development and body length. However, while full points were scored in several instances, there is still room for improvement. Back fat was good, but in a number of cases carcasses were not finished and could have carried more fat, while on the other hand there were a few carcasses over-fat. Ham development should receive the attention of breeders and shoulders were inclined to be heavy.

Darling Downs.

At Toowoomba arrangements were made by the District Pig Adviser (Mr. C. Porter) in co-operation with the management of the Darling Downs Co-operative Bacon Association, who made facilities available for judging and provided luncheon. A field day also was arranged, at which approximately 40 farmers attended.

Twenty-one entries were judged. Eye muscle development was not as good as in other districts and should receive the attention of farmers; again the back fat was good, but many carcasses could have carried a little more finish. Body length was good, a number of carcasses scoring full marks. However, there was a percentage of short length pigs and selection of type could receive attention. This is borne out by hams and shoulders, which could stand improvement in many cases.

Southern Queensland.

At Brisbane, arrangements for a field day and judging were made by Mr. E. Melville (Senior Adviser), together with the management of the Queensland Meat Industry Board, who also provided afternoon tea.

Eye muscle development was disappointing except in one or two instances, and body length in relation to carcass weight could be considerably improved. Back fat thickness was good, all carcasses scoring well, while hams and shoulders showed improvement.

Summary.

As in last year's competitions, the English method of appraisal was used in judging the carcasses and to qualify in this competition the dressed carcass had to weigh 120 pounds and not more than 180 pounds.

The 103 entries which complied with this year's conditions of entry had an average score of 67.97 per cent.

The average for each section of the judging is given in the following table:—

—	Possible Points.	Average Points Obtained.	Percentage of Possible Points.
By Inspection—			
Hams	8	6·27	78·4
Shoulder	7	5·92	84·57
Streak	12	5·57	46·4
By Measurement—			
Eye Muscle of Loin	28	18·04	64·42
Thickness of Back Fat	20	15·26	76·30
Body Length	20	13·06	65·30
Leg Length	5	3·02	60·40
Total	100	..	67·97

The accompanying photographs have been supplied by the Australian Meat Board.

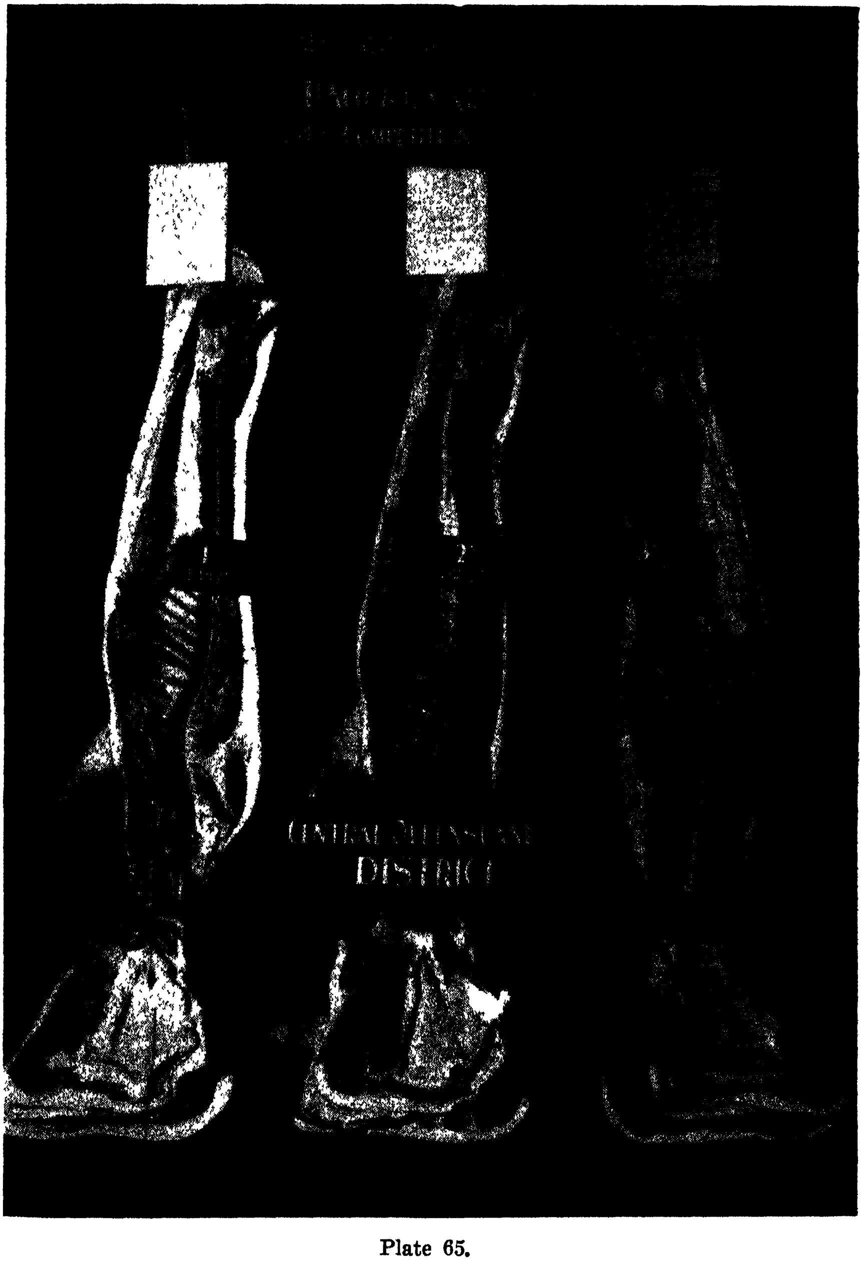


Plate 65.

CENTRAL QUEENSLAND DISTRICT PRIZEWINNERS.—First 81½ points, Second 78 points, Third 77½ points.

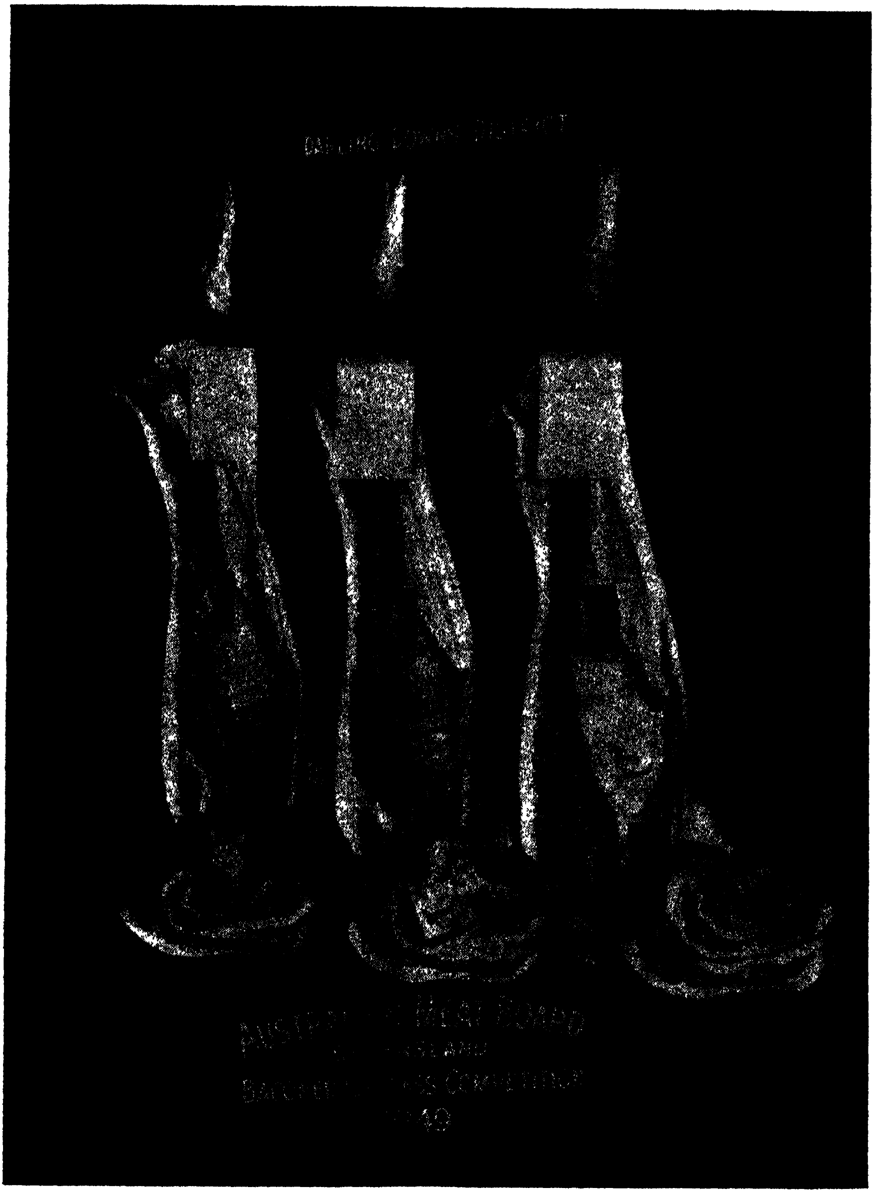


Plate 66.

DARLING DOWNS PRIZEWINNERS.—First 75½ points, Second 74½ points, Third 74 points.

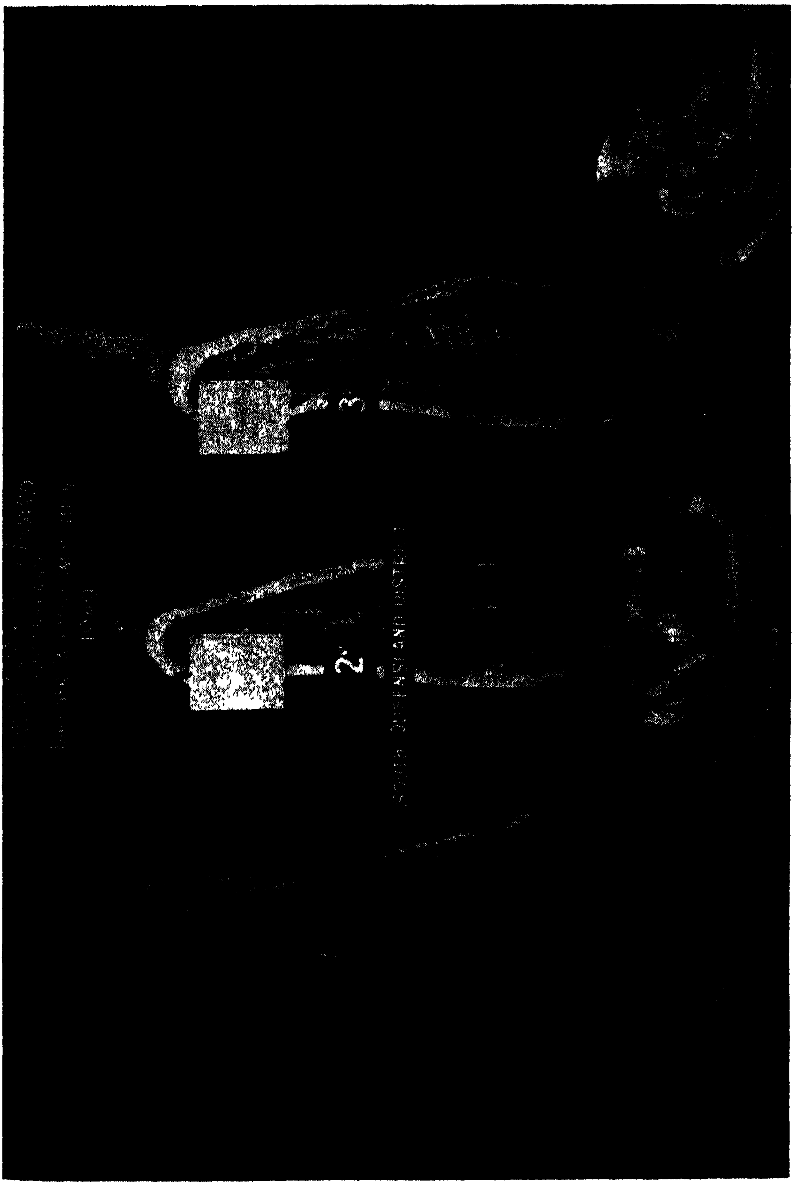


Plate 67.

SOUTH QUEENSLAND DISTRICT PRIZEWINNERS.—First 79½ points, Second 79 points, Third 75 points.

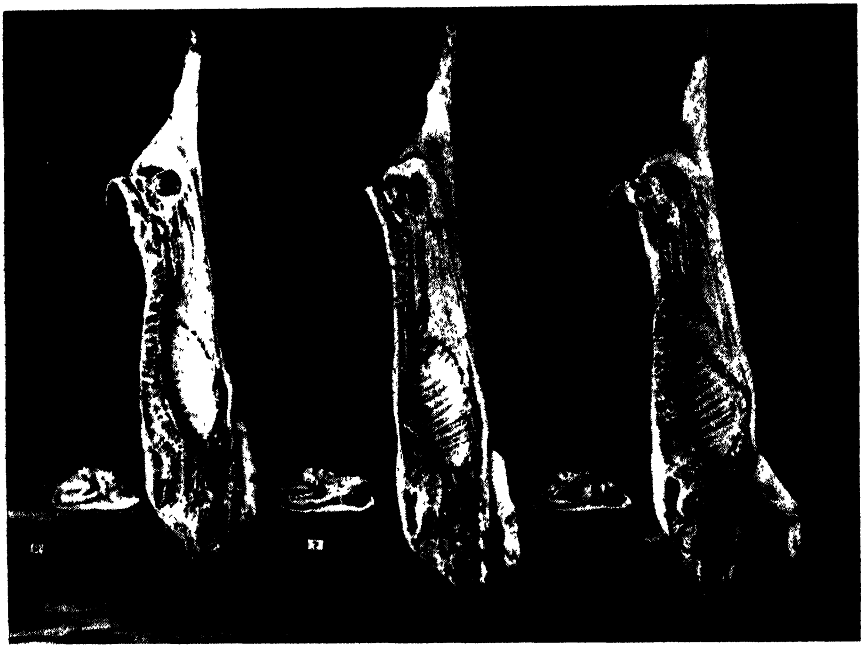


Plate 68.

NORTH QUEENSLAND DISTRICT PRIZEWINNERS.—First (No. 9) 82 points, Second (No. 7) 79½ points, Third 77 points.

TUBERCULOSIS-FREE HERDS.

During the past few years a number of cattle owners have submitted their stud herds to annual tuberculin tests and have freed their herds of tuberculosis. These herds are maintained free of the disease by making sure that only tested animals are introduced to the herd or that the animals are tested as soon as practicable after introduction.

It is intended to publish each month a list setting out the names and addresses of owners of studs whose herds are certified as being free from tuberculosis in accordance with the terms of the Agreement Form which owners are asked to complete.

Those owners who have had previous tests will still be required to complete the Agreement Form before their herds can be listed. Two consecutive clean tests are necessary for tuberculosis-free status, and an official clean test carried out prior to the signing of the agreement will be accepted as the first of the two tests.

Blank Agreement Forms can be obtained on application to a Departmental Veterinary Officer or Inspector of Stock.

TUBERCULOSIS-FREE HERDS (AS AT AUGUST 1, 1949).

Breed.	Owner's Name and Address of Stud.
Aberdeen Angus	The Scottish Australian Company Ltd., Texas Station, Texas

Poultry Nutrition : Principles and Practices.

P. RUMBALL, Officer in Charge, Poultry Branch, and F. N. J. MILNE,
Assistant Husbandry Officer (Poultry).

(Continued from page 120 of the August issue.)

FOODS AND THEIR USES.

Grains and Grain By-products.

Barley.

Barley is not a popular food among poultry-keepers, and fowls do not consume it readily. It has a fair feeding value, but in order to increase its palatability it should be soaked or sprouted. When corn and wheat are high in price barley may be used to the extent of 50 per cent. of the grain mixture, but the change should be gradual. As a meal barley may be used freely in mashes.

Beans and Peas.

Fowls do not take kindly to whole beans or peas, but if they are crushed they will add to the protein content of the mash and may be used to the extent of 5 per cent.

Grain Sorghum.

Sorghums are slightly higher in protein content than maize. They may be used extensively as a grain or as a meal in mashes. Fowls appear to have a greater liking for the lighter coloured grain than for the darker varieties.

Maize.

Maize is one of Queensland's staple grain crops. Poultry eat it readily. Large grain should be cracked, but the smaller varieties can be fed whole. When purchasing maize for grain feeding, it is advisable to secure the small grain. The quality is then easily judged and there is no waste. Cracked grain should always be sieved before being used and the fine powder used in the mash. Yellow corn should be used in preference to the white because of its vitamin A content.

Oats.

In some places oats is one of the principal poultry foods, but as most of Queensland's supply is imported it cannot be used economically in large quantities. It is, however, desirable to add variety to the ration of breeding stock by using a proportion of oat grain. Only plump, full oats are suitable for extensive use.

Sunflower Seed.

Sunflower seed is a valued addition to grain mixtures. It has a high fat content and consequently is not suitable for extensive use. Its protein content is about 16 per cent.

Whole Rice.

Rice is a very starchy food of a fattening nature, but can be used to the extent of one-third of the grain ration. Crushed or ground rice should be used with care. It has a tendency to go rancid and is also high in fibre.

Wheat.

Wheat provides the bulk of our poultry food. It is readily consumed by poultry and can be fed as a part or whole of any grain ration, the market price of various grain foods available being the guide as to the quantities used. Plump wheats of a hard nature are of better feeding value than pinched grain or full soft grains.

Bran.

Bran is rich in protein and mineral matter but contains a considerable quantity of fibre. This fibre is useful in adding bulk to the ration. It also assists in making a wet mash of a desirable consistency. It may be used at the rate of up to 30 per cent. of the mash.

Pollard.

Pollard has a greater proportion of carbohydrates than bran, but not so much ash and fibre. It may form the principal constituent of mashes and be used to the extent of 60 per cent. of the total mash.

Foodstuffs of Animal Origin.

Blood Meal.

Though blood meal has a high protein content, it is not a highly satisfactory food for poultry. Its use should be confined to finely-ground material that has not been burnt in processing. Its vitamin and mineral contents are low in comparison with those of other animal by-products and it should never be the only source of protein of animal origin used.

Liver Meal.

Liver meal is a very valuable adjunct to a poultry ration. It has a high protein content and has twice the riboflavin content of buttermilk powder and dried whey. In a chick starting mash 5 per cent. of liver meal will meet the riboflavin requirements and 3 per cent. or more of breeder's ration will ensure an adequate riboflavin level as well as enhance the protein value of the mash.

Meatmeals.

Meatmeals vary considerably in composition. They are essential for high egg production. When poultry are kept in closed runs where no other class of animal food is available meatmeals may be necessary to build up the protein content of rations to the necessary level.

Milk Powders.

Buttermilk powders and whey powders are very desirable additions to rations for both chickens and breeding hens. Like liver meal, they are a very good source of riboflavin. Buttermilk powder is frequently used to the extent of 10 per cent. of chicken starting mashes. Some whey powders appear to be very laxative and for this reason levels not exceeding 5 per cent. are suggested.

Milk.

There is no better animal protein-rich food for stock than milk. Skim milk, buttermilk, and whey—the most common milk products in Queensland—are foods of great value for poultry of all ages. Milk provides easily digested proteins, in addition to lactose, minerals, and vitamins, all of which are important for development, production, and health. Where skim milk is used to mix moist mashes, increased consumption and better development of young stock and increased production from layers follow. The lactose in the milk also helps to build up resistance to disease by keeping the intestines in a healthy state.

Fresh and soured milk are equal in food value. The feeding of milk as a drink is the only method by which quantities can be consumed by the fowl. Care must be exercised to see that the vessels from which milk is fed to poultry are kept clean and putrefaction avoided. Many adopt the practice of feeding the curds only, rejecting the whey. Whey, however, also has a definite food value, and should be used. When fowls are fed milk in open vessels considerable soiling of the feathers takes place. This gives adults an objectionable appearance and seems to affect the general health of young growing chickens. Therefore, chickens should be forced to drink milk through a grid.

It is generally accepted that 1 gallon of skim milk is equal in protein value to nearly 1 lb. of meatmeal. Poultry farmers generally appreciate the necessity of efficient feeding, and to give their fowls the necessary amount of protein they should use prepared mashes or prepare mashes including meatmeal. These mashes are usually fed with grain, the birds being given an equal quantity of each. In these circumstances a sufficient amount of protein is made available to the birds. The farmer who has a supply of skim milk available for his fowls must depart somewhat from his ordinary practice, for skim milk is a protein-rich food; but how far he may do so depends on the quantity of the skim milk available. When fowls are supplied with skim milk to the extent of 5 gallons per 100 birds per day, no other protein-rich food of animal origin is necessary. However, if the birds are given only, say, one-half of this quantity, half the quantity of mash that is usually fed should be supplied and the grain increased by about 50 per cent.

When milk, mash, and grain are being fed to the flock it is generally a sound policy to give the birds all the grain they will consume and not force them to eat given quantities of mash. This will enable the birds to balance their own ration.

Dry Crushed Bone and Bone Meal.

Dry crushed bone and bone meal are essential for the development of the bony structure of young growing stock and beneficial to laying birds. Poultry-keepers who are a distance from markets may build up

a supply of mineral matter suitable for young stock by burning any bones about their property. After burning, the bones are easily reduced to a size to feed. One per cent. is a very useful addition to the ration of growing birds. Many of the meat and bone meals contain appreciable quantities of bone meal.

Vegetable Protein-rich Foods.

Coconut Meal.

The need for a substitute for wheat bran is always in evidence, and as this shortage is likely to continue the poultry farmer may, at times, be forced to incorporate a substitute for bran in his rations.

Apart from its nutritive value, bran is used to give bulk to a ration and improve its physical condition, thus encouraging a healthy intestinal action. Coconut meal has a similar effect, and when available may be used extensively. Its protein content (19 per cent.) is higher than that of bran, whilst the oil content (5 per cent.) is almost double.

English experiments, in which coconut meal replaced bran on a weight basis, demonstrated that a ration containing coconut was slightly superior for egg production to one containnig the same quantity of bran. In these experiments coconut meal was used to the extent of 25 per cent. of the ration.

However, as birds cannot tolerate large amounts of oils and fats, it is not recommended that the whole of the bran portion of the ration be replaced by coconut meal unless most of the other ingredients of the ration are particularly low in fat or oil content.

Cottonseed Meal.

Cottonseed meal, on analysis, would appear to be a splendid food for poultry, but in practice its extensive use has not given good results. A good grade may be used to the extent of 5 per cent., but this quantity should never be exceeded as it spoils the keeping quality and yolk colour of the egg.

Linseed Meal.

Rich in oils and proteins, also fibre, linseed meal may be used to the extent of 2 per cent. in the laying mash and increased slightly during the moulting period.

Peanut Meal.

Peanut meal is a protein-rich and easily digested food. Unless the fat content is low, the keeping quality is poor, as it is inclined to go rancid. It may be used to the extent of up to 5 per cent. in building up the protein content of a ration.

Roots and Tubers as Poultry Food.

Because of their bulk, most roots and tubers have a limited value as poultry foods, but when market values are low they may be fed economically. Principally on account of their heavy yielding capacity, however, mangels, sweet potatoes, and pumpkins may be grown, especially as supplementary foods. The value of these crops must not be over-estimated, and care must be taken not to incorporate too great a quantity of any of these roots or tubers without giving due consideration to the

ration in conjunction with which they are fed. As previously mentioned, the total daily food intake of poultry is limited to approximately 4 oz. dry weight daily, and they cannot cope with an exceedingly bulky ration.

Root crops and tubers range in moisture content from about 70 per cent. in sweet potatoes to 90 per cent. in mangels, the total dry matter, therefore, being from as low as 10 per cent. to slightly under 30 per cent. The nutritive ratio of these crops is very wide when compared with the usual concentrated foods usually fed to poultry. At the same time, as most of the bulk of these crops is water and not fibre, it has been found practicable to include them in the ration to the extent of 50 per cent. of the total weight of food.

In an experiment conducted at the National Institute of Poultry Husbandry, England, potatoes were used to supplement the poultry rations. Four pens of birds were used and these were fed as follows:—

—	Mash.					Grain. Oz. per Bird Daily.	Potatoes. Oz. per Bird Daily.
	Maize Meal	Pollard.	Bran.	Meat Meal.	Clover Meal.		
	Parts.	Parts.	Parts.	Parts.	Parts.		
Pen 1 .	37½	27½	20	10	5	1	0
Pen 2	25	27½	20	10	5	1	2
Pen 3 ..	12½	27½	20	10	5	1	3
Pen 4 ..	..	27½	20	10	5	1	4

NOTE.—During the first two months fish meal was fed, but this was replaced by meat meal 9 parts, plus 1 part of salt. Oyster shell was provided *ad lib* to all pens.

Although the average daily intake of food per bird is approximately 4 oz., some birds in this experiment consumed as much as 4 oz. of dry food in addition to 4 oz. of potatoes.

Therefore, when attempting to induce birds to consume the maximum quantity of root and tuber crops, it is advisable to feed them on a good laying mash, working in about 30 to 40 per cent. of steamed roots or tubers, and feeding grain at night. With this method the amount of grain fed could be reduced considerably.

Potatoes.

Of the roots and tubers dealt with in this section, potatoes are the highest in feeding value, but because of their market value it is only at odd times that they may be fed profitably to poultry. They contain 2.2 per cent. of protein and 17.4 per cent. of carbohydrates. By feeding them in a cooked state, mixed with the mash, there is practically no waste and the birds are encouraged to eat fairly large quantities.

Sweet Potatoes.

Sweet potatoes contain only 1.6 per cent. of protein, but are as high as 26.4 per cent. in carbohydrates; therefore, though their nutritive value is lower, they may be used to approximately the same extent as potatoes. Because of their size and the fact that they are palatable to poultry, sweet potatoes may also be fed in the raw state. Before being fed raw they should be chopped or split

Mangels.

Mangels are useful as poultry food, and may be used largely as roughage and fed as a mid-day meal to poultry. Although not taking the part of green feed, mangels are useful as an adjunct to any ration, being ready for harvesting in the spring, when dry conditions usually prevail in south-eastern Queensland. Mangels contain only .8 per cent. of protein and 6.1 per cent. of carbohydrates, and are nearly 90 per cent. water, but as the average yield per acre is high they are suggested as a good supplementary feed. They are palatable and poultry have a natural liking for them. If split and hung up just within reach of the birds, poultry are provided with a profitable pastime in pecking at them. Overfeeding of mangels may induce scouring.

Pumpkins.

Pumpkins are fed in much the same manner as potatoes, but as the seeds are reputed to be poisonous these must be removed before cooking or before being fed in a raw state. Pumpkins contain 1.7 per cent. protein, 5.2 per cent. carbohydrate, and about 90 per cent. moisture. Therefore, as it is low in feed value, the quantity of pumpkin in a ration should be less than that of potatoes or sweet potatoes when it is being utilised in their stead.

Swede Turnips.

Swede turnips may be fed in much the same manner as mangels, but are usually pulped or cooked and mixed with a wet mash, or split open and fed as a supplement to green feed and mash. They have about the same feed value as mangels and pumpkins, containing 1.3 per cent. protein and 7.2 per cent. carbohydrates.

Carrots.

Carrots contain vitamin A and when available would make a valuable addition to the ration. They have about the same nutritive value as mangels, but should be fed in a minced state, mixed with mash.

Grits.

Lime Grit.

Shell grit, limestone grit, and bone grit supply poultry with calcium. Plentiful supplies of oyster shell or ground lime should always be available, while bone may be supplied in the form of either meal or grit.

Hard Flinty Grit.

Hard pieces of rock, sand, &c., are necessary to enable poultry to grind their food, and should be in free supply, particularly with stock confined to pens. Without grit it is impossible for poultry to obtain all the nutriment from the food supplied, and any system of feeding without grit is wasteful.

Salt.

Salt needs to be well mixed with the mash; when wet mash is fed it may be dissolved in the water but when fed dry too much care cannot be exercised in thoroughly distributing it throughout the mash. Excessive quantities are poisonous.

FEEDING OF DUCKS.

Ducklings should not be fed until 48 hours after hatching. Water and coarse sand may be supplied when the ducklings are placed in their brooding quarters. Coarse sand should always be supplied to ducks, as its consumption aids digestion. Ducklings should be fed mashes similar to those used for feeding chickens. The mash should be moistened to a crumbly consistency and several feeds given daily. This system of feeding should be adopted until they are four weeks of age, and the numbers of feeds then reduced to three, and later to two.

From four weeks, mashes similar to those used for laying hens may be employed, but each mash should have its bulk increased by the inclusion of 25 per cent. of good succulent green feed. Bran and pollard have formed the major part in duck rations, and when available a mixture of pollard 2 parts, bran 1 part, green feed 1 part, with the addition of meatmeal and salt, may be used. Meatmeal should be added to the mash at the rate of 1 lb. for every 10 lb. of bran and pollard, and salt at the rate of 2 oz.

When skim milk is available curds may be used to replace the meatmeal. The curd from 1½ gallons of milk would be almost equivalent to 1 lb. of meatmeal. Although milk is a most valued food, it is not desirable to supply it to ducks as a liquid because of their method of drinking.

Root crops and pumpkins, when available at reasonable prices, form a useful addition to the ration of ducks. They should be fed as recommended in the section dealing with such fodders.

The feeding of grain to ducks is not practised extensively. A little at mid-day may be fed. Some breeders prefer to soak grains for ducks.

Clean water should be kept continuously before the birds, and the water should be sufficiently deep to permit the birds totally immersing their heads. This enables the bills and eyes to be kept clean. A constant supply of water is equally essential for both young ducklings and adults, but with the former the vessel should not permit of ducklings gaining access for the purpose of swimming.

FEEDING OF TURKEYS.

Feeding should be commenced 26 to 48 hours after hatching. Water and grit (coarse sand) may be given when they are placed in the brooder. The water should be given by means of a fountain to protect the young birds from drowning. The feeding practice may be either dry mash and grain, wet mash and grain, or an all-mash. If the all-mash method is employed, it should be changed when the young turkeys are about 10 weeks of age to mash and grain.

In the feeding of wet mash, frequent feedings should be employed during the early life. Start with five feeds per day, gradually reducing to one feed of mash and one of grain when the turkey chicks are 10 weeks old. The mash should be placed in small receptacles that offer the maximum protection from fouling and that obviate wastage of dry mash.

Turkeys, like chickens, require different rations for different ages. The starting ration should contain approximately 20 per cent. of crude protein. This may be continued until 10 weeks of age, when the protein level may be reduced to 15 per cent.

The kinds of food that they should receive are largely dependent upon what foodstuffs are available in the locality in which the turkeys are reared. There is one point that turkey raisers should remember, and that is that no single food supplies all the requirements of the young birds; it is therefore more economical to purchase some additional foods to supplement home-grown grains than to limit the ration to the foodstuffs grown on the farm.

The following ration, used at the Oklahoma Agricultural Experiment Station, has been reported as giving good results, and is one that could be used in many districts in Queensland:—

25 lb. bran	3 lb. cottonseed meal
25 lb. pollard	5 lb. dried buttermilk
25 lb. yellow corn	¾ lb. salt
7 lb. lucerne meal	¾ lb. powdered limestone
5 lb. meat meal (63%)	1½ lb. bonemeal

The average weights of turkeys raised in this experiment are most interesting and are as follows:—

Age.	Males.	Females.	Average Weight.
	Lb. oz.	Lb. oz.	Lb. oz.
4 weeks	..	..	0 12
8 weeks	2 6	1 14	2 2
12 weeks	5 1	4 0	4 8
16 weeks	8 9	6 0	7 4
20 weeks	12 0	7 14	9 14
24 weeks	15 8	9 9	12 8

In an experiment conducted in Great Britain at the Newton Rigg Farm the following rations were used:—

——	Starting. 1 to 10 Weeks.	Growing. 10 to 24 Weeks.	Fattening. 24 to 27 Weeks.
	Lb.	Lb.	Lb.
Pollard	25	25	..
Bran	22	26	20
Maize Meal	20	25	..
Sussex Ground Oats	10	10	10
Fish Meal	6	3	10
Soybean Meal	8	5	..
Cod Liver Oil	2	1	..
Salt	½	½	..
Ground Limestone	..	2	..
Dried Skim Milk	7	..	..
Crude Protein content of the above ration was :—			
	18%	15%	14%

Grain Mixture:—2 parts of wheat and 1 part of cracked maize.

Practice of Feeding.—A very crumbly mash was fed five times daily during the first week and half grain and half mash for the last feed in the day. This was reduced to four of mash and one of half grain and

half mash for the second week, three of mash and one of half grain and half mash for the third and fourth weeks, after which they received two mash and one half grain and half mash to within three weeks of killing. For the first four weeks chopped clover leaves were mixed with the mash. At eight weeks marrow-stemmed kale was fed at the rate of 12 lb. daily. Growers' mash was fed from 10 weeks to within three weeks of killing, when fattening mash was given three times daily in a crumbly state.

In the feeding of turkeys, consideration must be given to the class of food they are likely to gather while on range. Insect life and grass seeds plus succulent grass are all possibilities. Insect life is of a high protein nature, and when plentiful it may be very desirable to reduce the animal protein that is used with any mash mixture. In general practice, however, farm poultry and turkeys generally suffer from a lack of protein.

Feeding the Breeding Stock.

Turkey hens may lay as early as seven months when given a good start in life and fed a ration that is conducive to production, but production can usually be expected at about 11 months. For breeding purposes the turkey hen should not be too fat. A mash of bran 1 part, pollard 2 parts, plus 10 per cent. of meat and bone meal, with grain at night, will promote production and keep the birds in the best breeding condition. In addition to the above a plentiful supply of succulent green feed should be given, and shell grit should be available at all times. Where it is impossible to obtain green feed, lucerne chaff of good quality could be added to the mash to the extent of 10 per cent. When this is to be used it is better to soak it overnight. There may be localities where crushed grains would prove more economical than bran and pollard. When such is the case they may be used to advantage, but it is advisable to have some bran to give the mash a crumbly consistency, and where possible to use a mixture of crushed grains in order to add variety. When skim milk is available, it may be used to mix the mash or may be given to the birds to drink. The meat and bone meal may then be reduced to 1 lb. for every 1½ gallons of skim milk supplied.

American investigators of the United States Range Live Stock Experiment Station found that the following average quantities of food were consumed per bird per week over a period of 48 weeks:—Males, 5.88 lb.; females, 3.15 lb. A breeding pen of one male and 15 females would, therefore, consume, during a period of 12 months, 1,762 lb. of food.

FEEDING OF GEESE.

On most farms sufficient food in the form of grazing will be available for the adult flock of geese. Geese are good foragers, but when vegetation is scarce green feed and grain should be provided. About 2 or 3 oz. of grain should always be given per bird as an evening meal.

With goslings which are being prepared for market a ration such as is recommended for the feeding of other table poultry is recommended.

Goslings require no food for upwards of 36 hours after hatching, although up to this period they may be supplied with water and grit or coarse sand. At 36 hours they may be given their first feed, which

may consist of equal parts of bran and pollard and the same quantity of some grain, such as sorghum, wheat, maize, or barley, moistened preferably with milk to a crumbly mash. Finely-chopped green feed may also be mixed with the mash and will prove beneficial to the goslings. Clean sand, which should always be available to the goslings, may be sprinkled over the mash. Three feeds per day of the above mixture should be given for about one month. After this period, provided there is plenty of good grazing available in the form of succulent greenstuff, the number of feeds may be reduced to one.

To obtain a good marketable carcase goslings need to be fed liberally up to four months of age.

Geese, both young and adult, should always be kept supplied with good, clean drinking water, but the drinking vessels for the goslings should be so constructed that they can only get their heads into them.

The sitting goose should always be given a supply of grain as she is usually unable to collect sufficient food during the short time she is off the eggs.

SOIL AND WATER ANALYSES

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Attention of producers is drawn to the fact that the following analyses are carried out, free of charge, by the Department of Agriculture and Stock:—

1. Soil samples for fertility measurements;
2. Water samples to determine their suitability or otherwise for irrigation or stock use.

Unfortunately, in the past, many samples have been submitted which were valueless, either because they were incorrectly taken or were too small in quantity. **It is essential therefore that the information hereunder be strictly followed.**

SOIL SAMPLE

When analysing soil it is essential that details of the history of the area of ground in question be known. In addition, samples should be taken according to a set pattern. Therefore, when an analysis is desired, a request for instructions as to the correct method of taking samples of soil should be forwarded to the Department of Agriculture and Stock, William Street, Brisbane.

WATER SAMPLE

Samples of water should be taken, in the case of established wells or bores, after the pump has been running for some time. The bottle (same capacity as a beer bottle) to be used for taking the sample should be well washed and then rinsed out several times with the water to be tested before being filled. About 1 inch air space only should be left between the cork and the water.

In all cases, covering letters should accompany samples which should be marked clearly with the sender's name and address and forwarded to the Department of Agriculture and Stock, William Street, Brisbane.

ASTRONOMICAL DATA FOR QUEENSLAND.

OCTOBER, 1949.

By W. J. NEWELL, Hon. Secretary of The Astronomical Society of Queensland.

TIMES OF SUNRISE AND SUNSET.

At Brisbane.			MINUTES LATER THAN BRISBANE AT OTHER PLACES.					
Day.	Rise.	Set.	Place.	Rise.	Set.	Place.	Rise.	Set.
	a.m.	p.m.						
1	5.29	5.47	Cairns	36	22	Longreach	38	31
6	5.23	5.49	Charleville ..	28	26	Quilpie	34	36
11	5.18	5.52	Cloncurry	55	45	Rockhampton ..	13	7
16	5.13	5.55	Cunnamulla ..	29	30	Roma	18	16
21	5.07	5.58	Dirranbandi ..	18	20	Townsville ..	30	19
26	5.03	6.01	Emerald	22	16	Winton	44	36
31	5.00	6.04	Hughenden ..	40	30	Warwick	3	4

TIMES OF MOONRISE AND MOONSET.

At Brisbane.

Day.	Rise.	Set.
	p.m.	a.m.
1	12.30	2.03
2	1.29	2.46
3	2.27	3.22
4	3.22	3.54
5	4.15	4.24
6	5.06	4.51
7	5.58	5.17
8	6.50	5.44
9	7.44	6.13
10	8.40	6.44
11	9.37	7.20
12	10.34	8.00
13	11.31	8.47
14	..	9.41
	a.m.	
15	12.25	10.40
16	1.15	11.44
		p.m.
17	1.59	12.49
18	2.39	1·55
19	3.16	3.02
20	3.52	4.08
21	4.27	5.16
22	5.04	6.27
23	5.44	7.39
24	6.29	8.50
25	7.20	9.59
26	8.17	11.02
27	9.18	11.57
28	10.21	..
		a.m.
29	11.22	12.44
	p.m.	
30	12.21	1·23
31	1.17	1.57

MINUTES LATER THAN BRISBANE (SOUTHERN DISTRICTS).

Charleville 27; Cunnamulla 29; Dirranbandi 19;
Quilpie 35; Roma 17; Warwick 4.

MINUTES LATER THAN BRISBANE (CENTRAL DISTRICTS).

Day.	Emerald.		Longreach.		Rockhampton.		Winton.	
	Rise.	Set.	Rise.	Set.	Rise.	Set.	Rise.	Set.
1	29	10	45	24	20	0	52	27
6	19	19	35	34	10	10	40	39
11	10	28	26	43	0	19	28	52
16	10	29	25	44	0	19	27	52
21	20	16	37	31	11	7	42	36
26	30	9	46	23	21	0	54	26
31	24	14	40	29	15	4	46	33

MINUTES LATER THAN BRISBANE (NORTHERN DISTRICTS).

Day.	Cairns.		Cloncurry.		Hughenden.		Townsville.	
	Rise.	Set.	Rise.	Set.	Rise.	Set.	Rise.	Set.
1	53	4	67	33	50	19	44	5
3	44	11	61	38	45	23	37	11
5	34	22	53	45	38	30	28	19
7	24	31	46	52	31	37	21	27
9	14	41	39	58	24	44	13	35
11	6	50	35	63	20	49	6	42
13	1	56	32	67	16	53	2	46
15	2	55	33	67	17	52	3	45
17	9	47	37	62	21	47	8	39
19	20	35	43	55	28	40	17	30
21	33	22	52	45	37	30	27	19
23	45	9	61	36	46	22	37	9
25	55	2	68	32	51	17	45	3
27	56	3	68	32	52	18	46	4
29	51	6	65	34	49	20	42	7
31	41	15	57	41	42	26	34	14

Phases of the Moon.—Full Moon, 7th October, 12.52 p.m.; Last Quarter, 15th, 2.06 p.m.; New Moon, 22nd October, 7.23 a.m.; First Quarter, 29th October, 3.04 a.m.

Eclipses.—There will be two eclipses this month—a total eclipse of the Moon on 7th October, and a partial eclipse of the Sun on 22nd October. The eclipse of the Moon will not be visible in Australia but on the 22nd, over the greater part of Queensland the Sun will rise with the disk of the Moon partly across it; and generally throughout the State the eclipse will end between 6.30 a.m. and 7.15 a.m. at the greatest phase less than half the Sun's disk will be covered by the Moon.

On 15th October the Sun will rise and set 10 degrees south of true east and true west respectively and on 6th and 20th the Moon will rise and set approximately at true east and true west respectively.

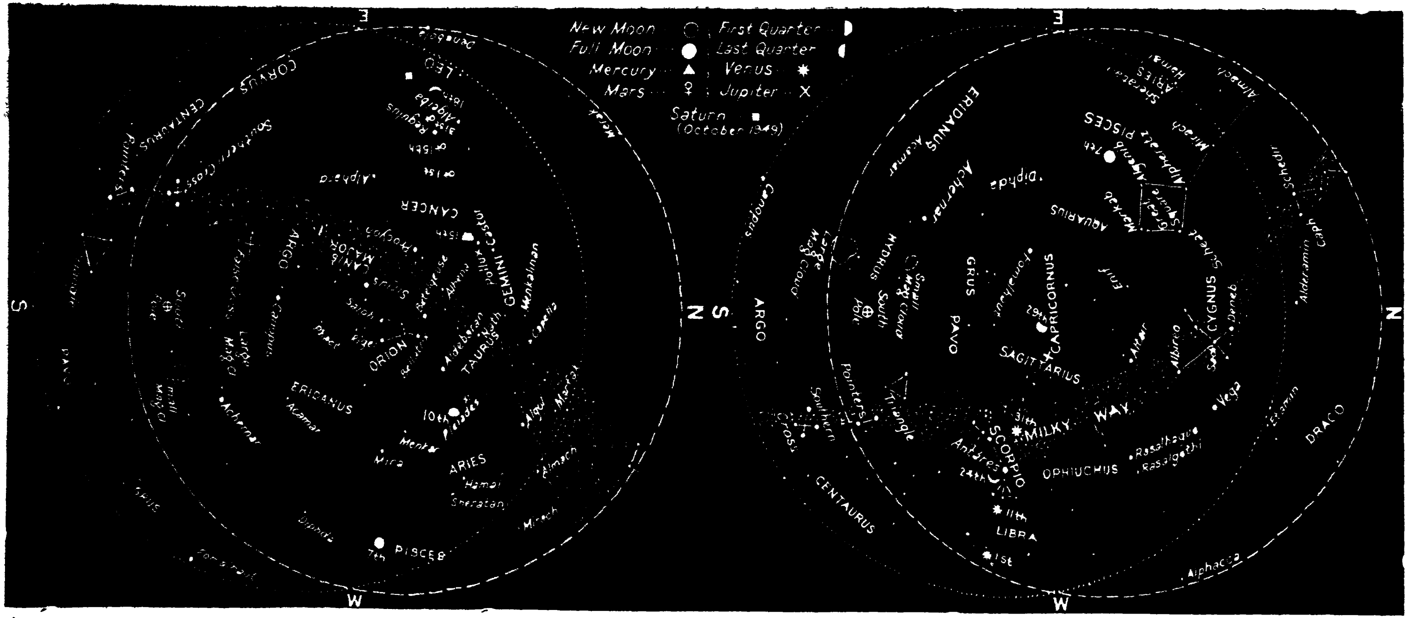
Mercury.—At the beginning of October, in the constellation of Virgo, will set half an hour after the Sun and will be in line with the Sun on 3rd October, after which it will pass into the morning sky and by the 19th will reach its greatest angle west of the Sun when it will rise 1 hour 30 minutes before sunrise. By the end of the month it will rise 35 minutes before the Sun.

Venus.—In the constellation of Libra, will set about 3¼ hours after the Sun at the beginning of the month and after passing through the constellation of Scorpio at the end of the month, in the constellation of Ophiuchus will set about 3½ hours after the Sun.

Mars.—At the beginning of the month, in the constellation of Leo, will rise about 2¼ hours before the Sun. On the 24th it will pass about 1 degree to the north of Regulus and at the end of the month will rise between 1.45 a.m. and 3 a.m.

Jupiter.—Setting just after midnight at the beginning of the month, at the end of the month will set about midnight.

Saturn.—May now be seen in the Eastern morning sky when on the 1st it will rise about 1 hour before the Sun and on the 31st about 2½ hours before the Sun.



Star Charts.—The chart on the right is for 7 15 p.m. in the south-east corner of Queensland to 8.15 p.m. along the Northern Territory Border on the 15th October. (For every degree of longitude we go west, the time increases by 4 minutes.) The chart on the left is for 9 hours later. On each chart the dashed circle represents the horizon as viewed from Cape York and the dotted circle is the horizon for places along the New South Wales Border. When facing north hold "N" at the bottom; when facing South hold "S" at the bottom and similarly for the other directions. Only the brightest stars are included and the more conspicuous constellations named. The stars which do not change their relation to one another, moving east to west, arrive at any selected position about 4 minutes earlier each night. Thus, at the beginning of the month the stars will be in the positions shown about 1 hour later than the time stated for the 15th and at the end of the month about 1 hour earlier than that time. The positions of the Moon and planets which are continually changing in relation to the stars, are shown for certain marked days; when no date is marked the position is for the middle of the month.

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Contents

Sorghum Growing in Queensland.

(Including Grain Sorghums, Sweet Sorghums, and Sudan Grass.)

L. G. MILES, Senior Plant Breeder, Agriculture Branch.

THE SORGHUM GROUP.

General and Historical.

THE genus *Sorghum* includes a wide variety of grain-bearing plants, ranging in type from tall tussocky grasses to the thick juicy-stemmed sweet sorghums of the type of Saccaline and Imphee. The main groups which have been cultivated throughout the world are (i) grain sorghums (mainly for grain), (ii) sweet or fodder sorghums (for green feed or ensilage), (iii) broom millet (for brooms and brush-ware), and (iv) Sudan grass (for grazing, hay and ensilage).

Another member of this genus which is widely distributed throughout Queensland is Johnson grass, an important weed of cultivated crops. *Sorghum verticilliflorum* is a further species, which is frequently seen along railway embankments throughout coastal Queenesland; it has a similar appearance to Sudan and Johnson grasses but has no economic importance in the State.

It is proposed in this article to deal with the cultivation in Queensland of grain sorghums, sweet sorghums, and Sudan grass. Broom millet is not included because it is not grown as a food crop, and, on account of the special handling required, its culture is dealt with in another pamphlet.

Cultivated sorghum is a crop of great antiquity. It is claimed to have been grown by the Chinese earlier than 2000 B.C., and was grown in Egypt in biblical times. The main centres from which it has spread into modern cultivation are Southern Asia (including China and India), Asia Minor, and North and South Africa. In most of these countries it has provided a staple cereal for human food, in addition to both grain and fodder for animals. It is only in more highly civilised modern communities, where wheat, oats and other cereals are plentifully available, that sorghum grain has been relegated to the position of a stock food.

During the latter half of the nineteenth century, many sorghum collections were made by botanists travelling in Africa and Asia, most of which found their way to the United States of America, where conditions were much better suited to their growth than in northern and western Europe. In America they rapidly gained favour, particularly in the drier mid-western and south-western States, where rainfall was often insufficient for successful maize crops. It is from the United States that many of our most successful importations have come.

Climatic and Soil Requirements.

The sorghum group are generally regarded as summer-growing annuals, though Sudan grass may function as a biennial and grain sorghums have also been known to survive a mild winter and provide a ratoon crop during the subsequent spring. For reasons of pest control, however, such ratooning is regarded as highly undesirable in grain and fodder sorghums, which crops will here be treated purely as annuals.

The crop requires a warm summer growing period of three to five months with ample rainfall interspersed with sunny periods. It has been definitely established that plants of the sorghum group are relatively drought resistant and require less rainfall for a unit crop of grain or fodder than does maize. This does not mean, however, that sorghums will not respond to seasons of good rainfall. Sorghums in Queensland frequently fail (particularly in grain production) through insufficiency of soil moisture, and within certain limits the better the rainfall received during growth the better the crop will be.

It is prolonged periods of wet and overcast weather which are detrimental to the crop, particularly if they occur during the later stages of growth. The more important harmful effects of such wet conditions are (i) the development of leaf diseases which seriously affect the feeding value of the crop, (ii) the encouragement of insect pests within the seedheads, and (iii) the spoiling of mature grain through moulding or partial germination.

Sorghums are susceptible to frosts during the growing period and may be completely killed if temperatures are sufficiently low. As the plant approaches maturity the effect of frost is to kill the green portions and to arrest any further development of the grain. If frost is experienced just prior to maturity (when the grain is fully formed), maturity may be hastened but no loss in either yield or quality of the grain will result. Earlier frosts will cause premature ripening of partially formed grain, which will finish in a badly pinched condition. Such early frosts will result in serious loss or even in total failure of the grain yield. As stalks may become very brittle after frosting, heavy losses may also result from lodging of frosted crops; in this respect some varieties (for example, Kalo) are notably worse than others.

The sorghum crops are suited to a wide range of soil types varying in texture from light loams to heavy clay soils. While best results can normally be expected from free-working soils of high fertility, useful returns are frequently obtained from second class agricultural lands. The relative drought resistance of these crops allows them to be grown on soils of lower moisture holding capacity than would normally be recommended for maize in the drier farming districts. Sorghum crops are also regarded as offering better crop prospects than maize on soils of medium or poor fertility.

On the score of climatic and soil requirements it will be seen that the sorghums are well adapted to summer planting over a wide range of the subcoastal agricultural districts from southern to central Queensland. Sweet sorghums have also been grown with considerable success in many of the coastal districts. The growing of grain sorghums in coastal areas is not generally favoured, because of the adverse effects of excessive rainfall. Where the mean annual rainfall in coastal districts is less than 45 inches, there is, however, some scope for expansion with openheaded varieties, which appear to be less subject to attack by caterpillars.

Seed-bed Preparation.

Although sorghums are able to grow under comparatively dry conditions, they require a moist seed-bed for satisfactory germination and early establishment. Ploughing should be carried out in winter or early spring with the object of leaving the soil in a rough condition for optimum absorption of storm rains and building up of sub-soil moisture. Subsequent cultivation should be aimed at maintaining a clean fallow and preparing a good surface tilth for the final seed-bed. The seed at planting should be placed in contact with good moisture at a depth of approximately 2 inches. If the final seed-bed is too cloddy it is likely to dry out to that depth before germination has occurred; this danger is considerably greater in summer time than in winter, necessitating the preparation of a finer seed-bed for sorghums than may be required for the winter cereals.

Seed.

The necessity for the use of seed of good quality cannot be too strongly emphasised with crop plants of the sorghum group. Uniformity of size, freedom from rubbish, a high germination percentage and trueness to varietal type should be prerequisites of planting seed of any agricultural crop. Members of the sorghum group readily intercross with each other, and the hybrid (or crossed) plants are nearly always taller and more vigorous than the parent varieties. This is particularly so in the case of crosses between a grain sorghum and a sweet sorghum or a grain sorghum and Sudan grass. The disadvantages of a mixed or badly hybridised seed supply are most apparent in grain sorghum crops (Plate 69), where uniformity of heading height is essential for efficient harvesting. The presence of tall strangers or hybrid plants in a field of grain sorghum slows up heading by frequent choking of the comb and elevator, and reduces yield because they contribute nothing to the grain harvest. In the case of Sudan grass it should be needless to stress the danger of introducing Johnson grass or hybrids between Sudan and Johnson grass with seeds of this widely grown crop.

The farmer's best guarantee of obtaining seed of good quality and uniform varietal type is the purchase of *certified seed.* All such seed is certified by Government officers as to its varietal purity, freedom from weed seeds and inert matter, and satisfactory germination percentage. It should be remembered, however, that certified seed can be legally sold only in unopened containers which bear the Government's seal and a certification label carrying the name of the variety and other details concerning the origin of the seed. Four varieties of grain sorghum are now eligible for seed certification, and it is intended to expand the scheme very soon to include five varieties of sweet sorghum and one or more varieties of Sudan grass. Where certified seed is not available,

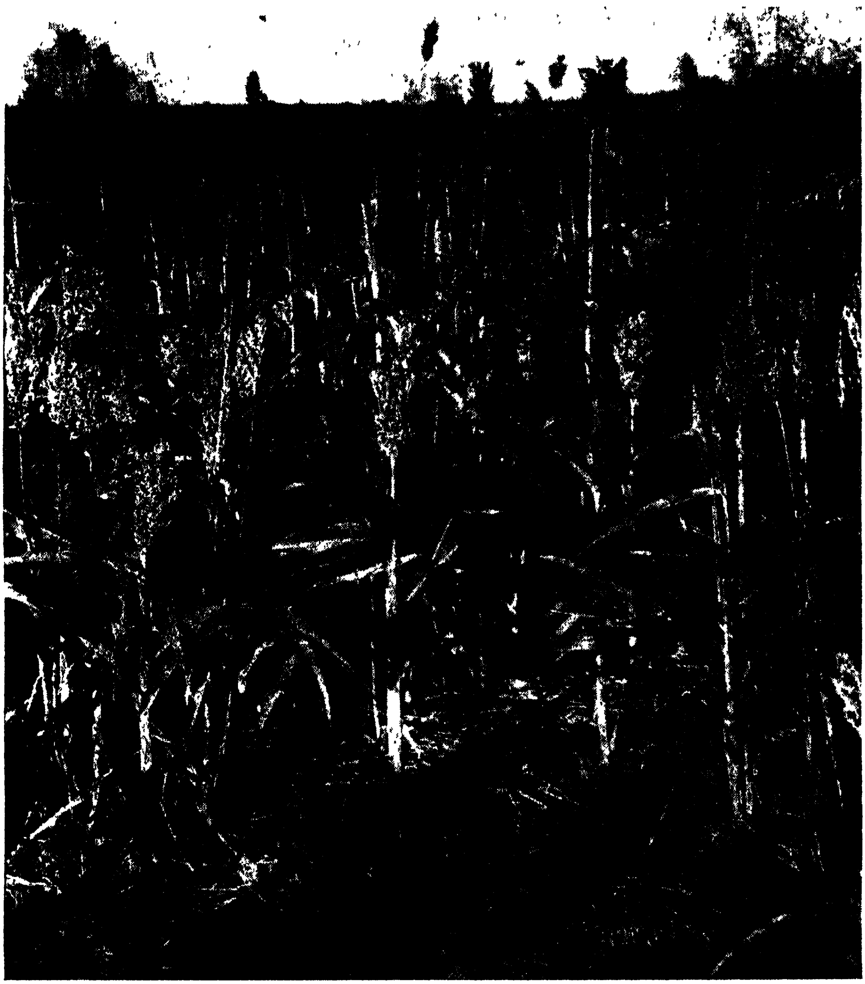


Plate 69.

RELIABLE SEED IS ESSENTIAL.—The farmer asked for "Milo" seed, and this is what he got. Such crops are impossible to harvest satisfactorily, and provide ideal breeding grounds for midge and other pests.

seed should be secured only from a reliable source, preferably from a known pure stand which was free from disease and grown at least a quarter of a mile away from any other variety or any other plants of the sorghum group. Such seed should be bright, plump, and free from foreign matter, and should give a good strong germination of better than 70 per cent.

It is recommended that all seed of grain sorghum and sweet sorghum be treated with a protective dust prior to sowing, to ensure freedom from covered kernel smut. This precaution is unnecessary if the seed has been obtained from a perfectly clean crop and if there has been no risk of contamination through harvesting or cleaning machinery. The recommended treatment is a thorough dusting with copper carbonate, "Ceresan" or "Agrosan" at the rate of 2 oz. per bushel.

Growing Period.

Sorghum and Sudan grass crops normally require three to five months from planting to maturity, and virtually the whole of this growing period must be within a frost-free season. This latter consideration, coupled with the incidence or likely incidence of rain, governs the planting period in Queensland. Successful plantings have been made as early as August and as late as February, but planting either too early or too late is fraught with considerable risk and cannot be recommended. There is often a big inducement for dairy farmers to plant early in the spring to provide much needed grazing or grain. A further reason for early planting is the desire to avoid heavy grain losses due to sorghum midge. The main drawbacks to early planting are the irregular incidence of the spring storms, and the possible risks of frost injury to the young crop and of wet-season rains at harvest time. There is, however, quite a scope for early planting during most years, particularly on soils of good moisture-holding capacity following a suitable period of fallow. Such plantings should not be made until the soil has begun to warm up and until after the normal expectation of late frosts; September is often a good month for this purpose. Grain sorghum varieties planted at this time should either be very early-maturing (enabling them to be harvested before the risk of the wet-season rains) or very late-maturing (allowing them to tide over the wet season). For example, Early Kalo has been planted in Central Queensland in September and harvested successfully in January, prior to the advent of the main summer rains.

The main-season plantings are usually made from November to early January, although such plantings must often survive a severe dry heat-wave period during January-February. Such plantings usually receive sufficient rain to produce a payable crop, except of course in marginal areas, and should mature before the advent of early frosts. January and February plantings of sweet sorghum are frequently made, particularly in coastal areas, where it is desired to have feed for stock during the early winter months.

Poisonous Properties of Sorghums.

Stems and leaves of all plants of the sorghum group may possess poisonous properties prior to the flowering stage. These properties are due to the presence in the plant of a complex substance termed a glucoside which yields prussic acid under favourable conditions. The grain, of course, is in no way affected by the presence of this poison in the growing plant. Much has been written about the soil and weather conditions likely to promote prussic acid development in toxic quantities, and it is generally held that stunted growth or growth that has been frosted prior to flowering is particularly dangerous. Indications are also that Johnson grass and crosses between Johnson grass and Sudan grass are usually highly toxic. On the other hand, there are known examples, covering periods of more than 30 years, in which pure strains of Sudan grass have been grazed annually at all stages of growth without stock loss. Also, there is no evidence of stock poisoning from feeding on sorghum or Sudan grass which has passed the heading stage.

It must be remembered, however, that serious stock losses have from time to time occurred as a result of their feeding on Sudan grass, sweet sorghum or grain sorghum (the latter both in the early stages of growth

and in the stubble stage following harvesting). The risk incurred does not deter numbers of dairy farmers and graziers from grazing their stock on plants of this group at many stages of growth. They regard these crops as too valuable on account of their hardiness to be ignored on the score of the risk of poisoning. It is therefore emphasised that the greatest caution should always be used in the feeding-off of these crops, particularly as there is no easy means of detecting the presence of prussic acid in dangerous amounts.

It is known that individual animals differ from each other in their ability to withstand dangerous doses of prussic acid. It is also known that most animals can acquire a certain degree of immunity to this poison by being accustomed to it gradually in small quantities. It is therefore essential when stock are first grazed on young sorghum or Sudan grass, or on grain sorghum stubble (which may contain considerable re-growth), to watch them carefully for the first few grazing periods. It is recommended that such stock should first be given their fill of other roughage before being allowed to commence their grazing on the sorghum crop. It is also recommended that they be allowed to graze the crop for a very short period the first day, and for somewhat longer periods on succeeding days until they are apparently quite safe with the crop. As soon as any of the stock show the slightest sign of going down, the herd should be immediately removed for the day, and remedial measures applied if necessary.

A number of antidotes for prussic acid poisoning have been suggested from various sources both within Australia and overseas. Only one of these treatments (the first) has been at all widely used in Queensland, and this is the treatment which is generally recommended. It must be remembered, however, that the action of the poison may be very rapid, and that the necessary ingredients must be on hand and must be administered swiftly if affected stock are to be saved. The dosages given are those which have been proposed for cattle.

(1) Drench with a solution of photographic "hypo," 2 oz. to a pint of water per beast, repeated if necessary at 3-hour intervals.

(2) Drench each beast with ½-teaspoonful of permanganate of potash and 2 lb. of glucose (or molasses) in a quart of water.

(3) Use molasses alone, diluted sufficiently to make a drench; administer 1 quart per beast.

Sorghum Crop Rotations.

Much has been written in the past concerning the adverse effects of sorghum crops upon the crops immediately following them. It was noted in the United States that many crops following sorghums were stunted in growth and showed signs of a pale yellow colouring in the leaves. Such experience led to the suggestion that sorghum roots secreted a toxic substance which remained in the soil for some months afterwards. This theory is now discredited, as it has been shown that such symptoms in crops following sorghums are often due to a temporary shortage of available nitrogen. Sorghum residues when ploughed under frequently contain a quantity of sugars which encourage microbial activity in the soil, such activity locking up most of the available nitrogen. When the

sugary material has all been utilised, the micro-organisms cease to multiply, and as they die and decompose the nitrogen is gradually made available again for succeeding crops.

In Queensland it is not recommended that a summer crop of sorghum or Sudan grass be immediately followed by a winter crop such as wheat. Fortunately this practice is seldom attempted, particularly as most farmers retain their stubble for grazing well into the winter period. Where sorghum residues are ploughed under during winter, a period of fallow should be allowed during the warm spring months before any non-leguminous crop is planted on the same land. In Central Queensland, where decomposition of crop residues and nitrification take place rapidly in moist soils during spring, no deleterious effects have been noticed when sorghums have been grown annually on the one field for a period of years, or when sorghum crops have been followed by other summer crops. In cooler districts, or in any areas in which other crops are considered to be harmfully affected by previous sorghum crops, the latter should be followed by a long fallow or by a leguminous crop grown preferably from inoculated seed.

Attack by Birds.

All crops of the sorghum group are subject to serious loss of grain through depredations of birds. As with a number of cultivated and native grasses, the seedhead is carried at the top of the plant where it is clearly visible from the air and unprotected from attack. All grain-eating birds are particularly fond of sorghum or Sudan grass seed, and few crops entirely escape their attention. In the neighbourhood of the larger centres of population sparrows may be a real menace, while in the more remote country areas parrots are of overwhelming importance. Grain may be attacked from the soft dough stage right through to maturity and many small seed crops have been entirely ruined through this cause. Where large areas are grown, either in the one planting or in closely adjacent smaller areas, the attack would normally be spread and the percentage loss minimised. Where areas are small and isolated, however, and particularly where there is ample timber in the vicinity, special precautions must be taken if a seed crop is to be harvested.

GRAIN SORGHUMS.

General and Historical.

Grain sorghums were introduced into Queensland at quite an early stage in our agriculture, but never attained a position of prominence until the present decade. The main reason for the slow initial development of this crop was the fact that the only varieties available in early years were relatively tall, and had to be harvested by hand. Isolated areas of Standard Yellow Milo, Feterita and a few other varieties might be found on widely scattered farms, but the crop was regarded more as a curiosity than as a grain crop of potential importance.

The question of mechanical harvesting of grain sorghums was never seriously considered even in the United States until dwarf and double-dwarf types were eventually discovered within such tall varieties as Standard Yellow Milo. While the standard variety averaged 5 feet or more in height, Dwarf Yellow Milo (first recorded in the early years of this century) averaged 4 feet, and Double-dwarf Yellow Milo (first

noticed about 1920) ranged from 2 to 3 feet high. These shorter growing Milo strains were not altogether suited for direct heading, particularly on account of their tendency to the "crook-neck" habit. Such types were, however, crossed with tall erect-growing Kafir strains, and selections from these crosses resulted in the straight necked dwarf varieties Wheatland and Beaver. It is from the time of liberation of these erect sturdy dwarf varieties (1928-1931) that the period of mechanical harvesting of grain sorghums really dates.

During 1932 and 1933 some 30 varieties of grain sorghum were introduced into Queenslnad by the Department of Agriculture and Stock from South Africa, Egypt and the United States. Included within this group were the dwarf varieties Wheatland, Kalo, Hegari, Day Milo and Brown Yolo. This range of varieties was tested in southern Queensland during the 1933-34 and 1934-35 seasons, and small seed increases were made of the most suitable dwarf varieties for distribution in 1935 to the Darling Downs and Biloela, and a few years later to Kingaroy. It is from these original distributions, of a few pounds of seed each, that Queensland's grain sorghum industry has developed.

The crop attained rapid popularity, particularly amongst dairy farmers on the Darling Downs and in the Burnett, Callide and Dawson Valleys. In the drier districts it soon began to displace maize as the major summer grain crop, because of (i) its greater security under conditions of irregular or insufficient rainfall, and (ii) its ability to be mechanically harvested. Although the first commercial plantings of these dwarf varieties were not made until about 1938, the annual production had risen within five years to over a million bushels. The table below indicates the development of production in Queensland during the 7-year period from 1941-42 to 1947-48.

Year	Area.	Yield.
	Acres.	Bushels.
1941–42	40,630	693,437
1942–43	54,868	1,341,305
1943–44	54,709	1,110,477
1944–45	49,451	918,780
1945–46	68,775	1,295,442
1946–47	116,079	3,355,322
1947–48	69,431	1,472,793

The high production figures for 1946-47 resulted very largely from the failure of the wheat crop in 1946. As wheat yields during the years 1947 and 1948 have been at a high level during a period of high wheat prices, there has been little inducement since 1946 for the large scale grain growers of the western Darling Downs to grow further crops of sorghum. It will readily be seen, however, that the annual production of this grain could be stepped up tremendously if occasion demanded. Queensland's present production should be greatly enhanced during favourable seasons by the operations of the Queensland-British Food Corporation in addition to a number of graziers in the Emerald district of Central Queensland.

The bulk of the grain produced by dairy farmers is for local consumption. When ground and fed with skim milk it forms the staple diet for pigs throughout much of sub-coastal southern Queensland. It is regarded as being almost the equal of maize in its food value, but it requires to be fed with some animal protein or with a legume such as lucerne for its own nutrients to be most effectively utilised.

Selection and seed purification have been applied to the original introductions, and a plant breeding programme was commenced at Biloela Regional Experiment Station in 1941. This programme, which has since been transferred from Biloela to Kingaroy, aims at producing new varieties better suited to Queensland conditions by means of selection and hybridisation. Many new strains have already been produced and tested, and four of these are described under the heading "Varieties" in subsequent pages.

Sowing.

Grain sorghum is almost wholly machine-planted in Queensland, using either a seed drill or a corn-planter. On the Darling Downs, as would be expected, the grain drill or combine is by far the most widely used seeder for sorghums. Since the planting runs of the drill are spaced 7 inches apart, it is possible to plant in rows at this spacing if so desired. Where a 14-inch row spacing is required, alternate runs are blocked; for a 21-inch spacing two runs out of every three are blocked, and so on. By this means it has been possible to obtain good stands in rows up to 3 ft. 6 in. apart, merely by blocking off the appropriate number of grain runs. It is often found when using a combine drill behind a rubber-tyred tractor, particularly on heavy black soils, that a poor strike occurs in rows following the heavy rear tyres. This is due to the compacting of the soil behind the tyres resulting in poor penetration of the seeding tynes following these tracks. A suggested remedy is to replace the standard planting hoes running in the tyre tracks with hoes approximately one inch longer; these enable better penetration of the seed to moist soil, resulting in stands comparable with the other rows.

In maize growing districts, such as the South Burnett, maize planters are still very popular for the planting of sorghums. Both 2-row and 4-row planters are commonly used, and suitable sorghum plates are substituted for the maize plates in the planting mechanism. Excellent results have been obtained from planters both of the press-wheel type and of the tyne-cultivator type, but the method is only adapted to the wider row spacings. Some farmers have made their own sorghum combine by bracing together two planters of the high wheel, tyne-cultivator type. The resulting implement is then used both as a 4-row planter and as an inter-row cultivator.

Seeding Rates and Row Spacings.

Row spacing trials and rate-of-seeding trials have shown that during seasons of ample rainfall there may be little difference in yield from row spacings from 7 inches up to 3 ft. 6 in. or seeding rates from 20 lb. down to 4 lb. per acre. Under such conditions the wider spaced plants tend to tiller more freely and to produce larger heads, thus compensating for the higher plant populations obtained by closer spacings. Under drought conditions, however, the wider spacings have often enabled the plants to set a grain crop where closer spacings have

failed entirely. The main benefit of the closer row spacings and heavier seed rates is in the suppression of weed growth and elimination of the necessity for inter-row cultivation. Closer spacings also tend to promote a more even heading height, which makes for ease of harvesting.

On the fertile, heavy black soils of the Darling Downs, excellent results have frequently been obtained with close row spacings ranging from 7 inches to 21 inches, particularly when moisture has been conserved by fallowing. On poorer soils, however, or in areas of lighter rainfall or heavier evaporation, wider row spacings ranging from 28 inches to 42 inches are strongly advocated.

The following table gives an idea of the seeding rates per acre commonly attainable by the use of the seed-drill (or maize planter for the wider spacings) for varying row spacings:

Row Spacing. Inches.	Seeding Rate. Lb. per Acre.
7	20
14	10
21	7
28	5
35	4
42	$3\frac{1}{2}$

It is generally felt, however, that 20 lb. per acre is an excessively high seeding rate, and attempts have been made, quite successfully, to reduce the plant population in the row under the closer row spacing conditions. This has been achieved by running a leather thong or a hook of fencing wire down each grain outlet in use. Planting rates per row can also be successfully reduced by replacing cog-wheels in the planting gear to alter the gear ratio. By the latter means a planting rate of 5 to 6 lb. per acre has been achieved at Peak Downs with a 14-inch row spacing.

Cultivation of the Crop.

When the crop is planted in drills which are wider apart than 21 inches, inter-row cultivation becomes a necessity on most soil types. Such cultivation assists in the aeration of the soil, controls young weed growth, and provides a broken surface to trap further rains. During the early stages of growth, cultivation is frequently carried out very cheaply and efficiently by means of the combine or tyned planter which was used for planting the crop. All that is necessary is to remove the planting tynes and follow the same course as was used when planting (Plate 70). For smaller areas, single-row and 2-row cultivators may conveniently be used as for maize. With larger areas in which wide row spacings have been used, tractor cultivating attachments provide a quick and efficient means of carrying out the work. Early cultivations may be deep, but later operations should be shallower so as not to injure the surface roots of the plants. The number of cultivations required cannot be specified, as so much depends upon the soil type, the prevalence of weeds and the incidence of rainfall.

Where spacings of 21 inches or less have been adopted, particularly on soils where weeds are likely to be a problem, it is advisable to harrow the young crop at right angles to the direction of the rows. This harrowing should be carried out during the heat of the day when the young sorghum plants are not inclined to be brittle. The young plants

Plate 70.
INTER-ROW CULTIVATION OF A YOUNG GRAIN SORGHUM CROP, USING THE THREE-ROW PLANTER WHICH HAD PREVIOUSLY BEEN USED FOR PLANTING THE CROP.

so treated should be well established, but not tall enough to be seriously injured by the harrows. This operation gives the crop an excellent advantage over weed competitors, and even the loss of a percentage of the sorghum plants may be a decided benefit where the stands within the rows are excessively heavy.

While hormone weedkillers have not yet been extensively used for weed control in sorghums, it is known that they are effective against many of the common weeds of cultivation. Should their use prove economic, they may conceivably supplant crop cultivation as a means of weed control where suitable spraying equipment is available.

Harvesting.

Sorghum grain in Queensland is almost universally harvested by means of the mechanical harvester-thresher (Plate 71). The old American method of hand-cutting of the heads followed by threshing in a stationary thresher has seldom been adopted in this State, and is never seen today on farm-scale plantings. Australian headers have handled the dwarf varieties with conspicuous success right from the outset, and it is upon this factor that the expansion of the crop has largely depended.

Harvesting should not be attempted until the bulk of the grain is thoroughly dry and cannot be dented with the fingernail. Sorghum grain is very susceptible to deterioration in storage, particularly in bulk storage, if it carries excessive moisture at harvest time. Grain with a moisture content of over 14 per cent. is almost certain to spoil if stored immediately.

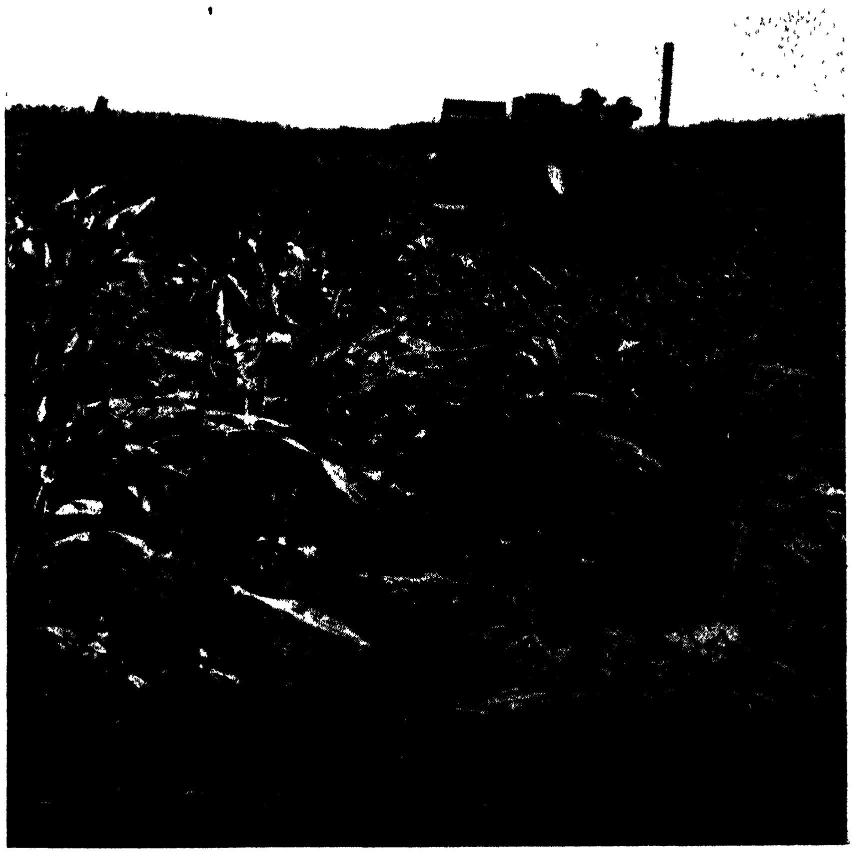


Plate 71.

HARVESTING OF GRAIN SORGHUM AT HERMITAGE REGIONAL EXPERIMENT STATION, NEAR WARWICK.

Most of our dwarf grain sorghum varieties can be harvested successfully without racking up the comb of the header to its full height. Where certain varieties, such as Kalo or Hegari, exceed 4 feet in height under good growing conditions, it is often necessary to use the full height of the comb and to use a roller in front of and above the comb to push the heads over to a suitable cutting level. The need for using good quality seed is particularly apparent at harvest time, for if the heads occur at several levels the comb must be racked down to accommodate the lowest heads, and as a result much useless trash is taken through the elevator and drum. Where a field presents a uniform level of heading, the harvesting process need be no more difficult than the handling of wheat or oats. It should always be remembered, however, that the proportion of trash taken in with sorghum heads is much higher than with the winter cereals. Thus in harvesting heavy crops or uneven crops it may be necessary to reduce the cut to half or two-thirds of the full comb in order to avoid stoppages due to congestion of the elevator, drum and riddles.

The adjustments made to harvesters for sorghum heading are normally very simple and may comprise: (i) wider spacing of the fingers of the comb to permit the entry of the relatively coarse stalks to the cutting blade; (ii) a slight reduction in the threshing speed to avoid excessive cracking of the grain; (iii) intensification of the blast to provide more effective winnowing of the bulky trash from the grain; and (iv) inversion of the top riddle to further facilitate clearing of the trash. Though relatively clean samples of sound grain are frequently obtained by the use of a well adjusted machine on a uniform and well matured crop, it is always advisable to reclean any seed required for planting purposes. Relatively small quantities can be readily cleaned by the use of hand sieves and the pouring of the grain from one tub to another on a windy day. Larger quantities are normally handled by special seed-cleaning machinery, or by pouring the grain on to the riddles of a clean header the machinery of which is driven by a power take-off from the tractor.

Yields of grain vary greatly from one season to another and one district to another, depending largely on the soil fertility, the incidence of rain and the presence or absence of insect pests. Many crops in drought seasons have failed completely in grain production, while yields of over 100 bushels per acre have been recorded under good conditions. Good average yields of 30 to 60 bushels per acre are frequently obtained on the better farms throughout the main sorghum districts, while quite useful yields of 15 to 30 bushels per acre may be anticipated in many of the more marginal areas in the majority of seasons.

Grain Storage.

Prolonged storage of any type of grain presents considerable problems. Some of the more important of these are deterioration of the grain due to excessive moisture content, serious damage due to weevil attack, and loss through the depredations of mice. The first of these problems can only be safely overcome by allowing the crop to mature thoroughly in the field. Here, however, difficulty often arises because secondary heading frequently occurs following rains late in the season. These secondary heads, which result from belated tillering or from actual branches from the primary stems, may carry immature grain at the time the main crop is fully mature. Under these conditions it is sometimes imperative to harvest the crop without delay, as the primary crop might well be a good one and excessive delay might cause considerable loss through grain weathering or through weakening and collapse of the old stalks. The presence of the green grain in such sample will raise the over-all moisture content and definitely rule out immediate bulk storage. Such grain can be readily dried out in fine weather by spreading in thin layers and stirring occasionally, but this treatment is beyond the scope of the large-scale grower. Samples which are only slightly above the critical moisture content will dry out satisfactorily in the bags provided the latter are not sewn for a few days and are exposed to fine weather in the field.

Bagged grain can be safely stored on the farm at a somewhat higher moisture content than that allowable for bulked grain in tanks or bins. Such bags, however, are preferably stored in an open dump upon a mouse-proof floor and with effective covering from weather. This arrangement is particularly suitable on farms where the bulk is to be utilised within the ensuing year for feeding pigs, poultry or other stock.

An adjacent crusher with a receiving bin at a handy height enables bags to be emptied from the top of the stack as required, and the grain to be ground for stock food. Moreover, experience has shown that the activities of weevils in such a stack cause little loss in actual feeding value throughout a 12-month period.

Where grain is to be stored for longer periods—for example, as a reserve against future droughts or seasonal shortages—tank or bin storage is the only safe means. The tanks used should be capable of being made airtight when filled, and the grain of course should be thoroughly dry before storage. Weevils can be effectively controlled in storage tanks by fumigation with carbon bisulphide at the rate of ¼ lb. per 1,000 gallons of filled storage space. Full details on the tank-storage of grain are to be found in the Department's bulletin on maize, and in Pamphlet No. 114, entitled "Stored Products Pests."

Feeding of Crop Residues.

The feeding-off of crop residues following the harvesting of the grain has often been criticised because of (i) the danger of sorghum poisoning and (ii) the doubtful food value of the stubble. The fact remains, however, that dairy farmers have for some years regarded grain sorghum stubble as one of their most useful roughages, particularly during the autumn and early winter. Many farmers have definitely been influenced in their choice of varieties by the quantity and the palatability of the residues after harvesting. Grazing of course in such paddocks is not restricted solely to the drying stalks and leaves of the primary crop, but also includes young suckers from the sorghum plants, and grasses and herbage which have grown within the crop. It is certainly safe to say that many dairy farmers in the past would have been forced to sell their stock or have them agisted during dry periods if they had not had available ample areas of grain sorghum stubble.

The palatability of the grain sorghum plant, though not as high as that of sweet sorghum, has also enabled dairy farmers and graziers to turn crop failures to profitable use during dry periods. Many grain sorghum crops which have been written off for grain production owing to excessively dry seasons have provided weeks of useful feed for dairy cows or breeding stock at periods when no other green feed was available.

On account of the proven fodder value of the crop (either before or after grain production) this aspect of its usefulness cannot be overlooked. It is, however, reiterated here, and cannot be stressed too much, that the greatest caution must always be exercised in the grazing of sorghum plant material because of the definite risk of sorghum poisoning.

Grain Sorghum Varieties.

The necessity for the use of seed of good quality and a high standard of purity has been stressed in an earlier section. It is important that farmers should know the main varieties available to them and should be able to ask for and obtain seed of specific varieties of proven performance in their districts.

It is very unfortunate that the term "Milo" should have gained such favour amongst farmers and seedsmen throughout the State. This term was applied originally in America to a group of sorghum types each characterised by certain constant features, but differing from each other in a number of minor attributes. A similar term applied to another

group of varieties of common origin was "Kafir." In Queensland, the term Milo is practically meaningless, as no true Milo types are now commercially grown. Wheatland was originally introduced as Wheatland Milo, but this term was really a misnomer, as Wheatland originated from a cross between a Milo and a Kafir and bears certain characteristics of both groups. The term Milo has long been dropped from the original Wheatland Milo, and Wheatland is now its accepted name both in the United States and in this country. Day Milo was another early introduction which is in many respects a true dwarf Milo type; this variety has, however, practically disappeared from cultivation in Queensland. There is therefore no excuse for the retention of the term Milo in Queensland sorghum culture, particularly as its use only leads to misunderstanding and confusion. Farmers and seedsmen are urged to discontinue the use of this word, and to know and ask for grain sorghum varieties by their correct names.

The following brief descriptions refer to three of the varieties originally introduced into Queensland in 1932-33, in addition to four varieties developed locally and three more recent introductions from the United States of America which are at present undergoing test. It should be realised in reading these descriptions that they are intended to give an average picture of each of the varieties dealt with. Unfortunately, most sorghum varieties vary considerably from one site to another and one season to another, making it impossible to provide descriptions that will fit all situations. Thus a variety which normally has straw-coloured glumes or hulls may under certain conditions develop black or blotched glumes; a variety which is normally of medium height may under differing conditions reach a height of 5 to 6 feet; or again one variety may be earlier maturing than another in one district while in a different district the reverse may be true. A good example of the last effect is afforded by a comparison of Wheatland and Kalo. In Central Queensland Wheatland has almost always proved earlier than Kalo by at least a few days, whereas on the Darling Downs Kalo is considered to be unquestionably earlier than Wheatland. Such variations will be referred to where they are known to occur.

Wheatland (Plates 72 and 77).

This is one of the original dwarf varieties introduced into Queensland, and has been a standard variety up to the present day. It is a true double-dwarf, ranging in height from 2 ft. 6 in. to 3 ft. 3 in. It normally heads within 50 to 70 days of planting and matures in approximately four months (generally later on the Darling Downs). The variety tillers quite freely, and may produce frequent stem-branches following late rains. Foliage is rather stiff and harsh; the leaves are crowded at the base of the plant and are typically erect and somewhat twisted, giving a characteristic appearance to the variety; the midrib is cloudy to white. Heads are normally broad and irregularly cylindrical, and are of medium density. The variety is awnless. Glumes are typically black, sometimes blotched. The grain is usually large, varying to medium size under drier conditions, pale yellow in colour and well rounded in outline. Main advantages of this variety are its low height (for ease of heading), its stocky habit (enabling it to stand up well under most conditions) and its general reliability. Main disadvantages are its unevenness of heading height in seasons of irregular rainfall and the poor quality of the crop residues after heading. There

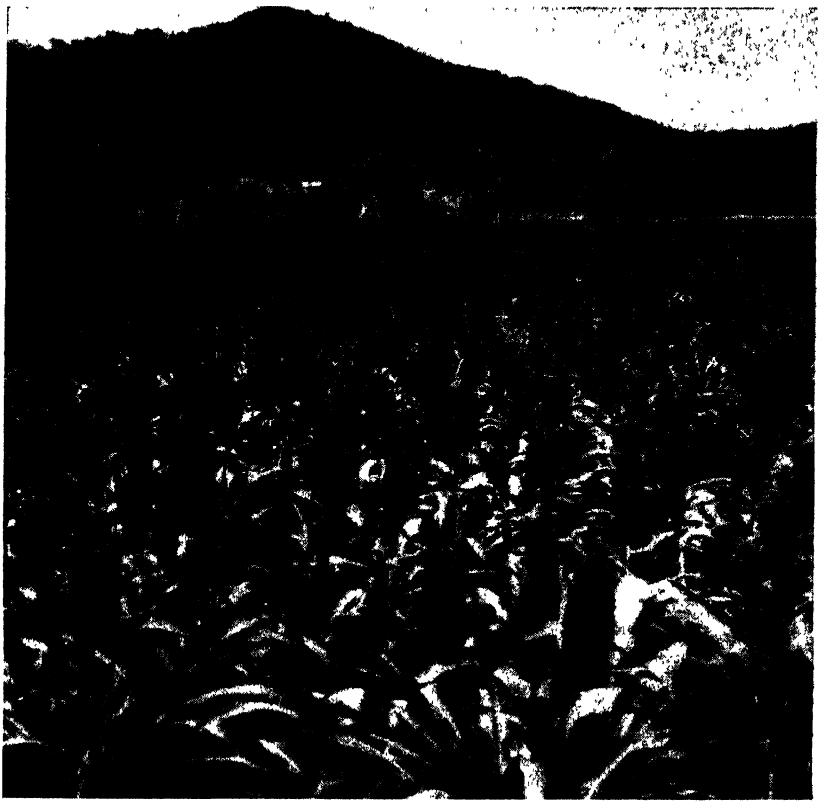


Plate 72.

WHEATLAND.—A crop in coastal Central Queensland.

is also a tendency for the heads of this variety to "blast" when flowering occurs in hot dry weather, resulting in much sterility and grain loss; this condition has been noted several times in Central Queensland. Wheatland is the most popular variety in the South Burnett and is also extensively grown throughout the Upper Burnett and Central Queensland. It has lost popularity on the Darling Downs, where it has been largely displaced by Kalo. Certified seed of Wheatland is now being produced in considerable quantity.

Kalo (Plates 73 and 78).

This is another of the original dwarf varieties introduced from the United States of America. It is not a double-dwarf variety, and is frequently somewhat tall for header harvesting. Its height ranges from 3 ft. 6 in. to 5 feet, but on black soil it seldom exceeds 4 feet. It heads normally in 55 to 75 days from planting and matures in approximately four months. Kalo carries good foliage which is well spaced up the stems and is typically turned over towards the tips and not held erect as in Wheatland. The midrib is cloudy, indicating juiciness of the leaf and stem. Heads are typically long and club-shaped, and of medium density. The variety is prominently awned, the awns being

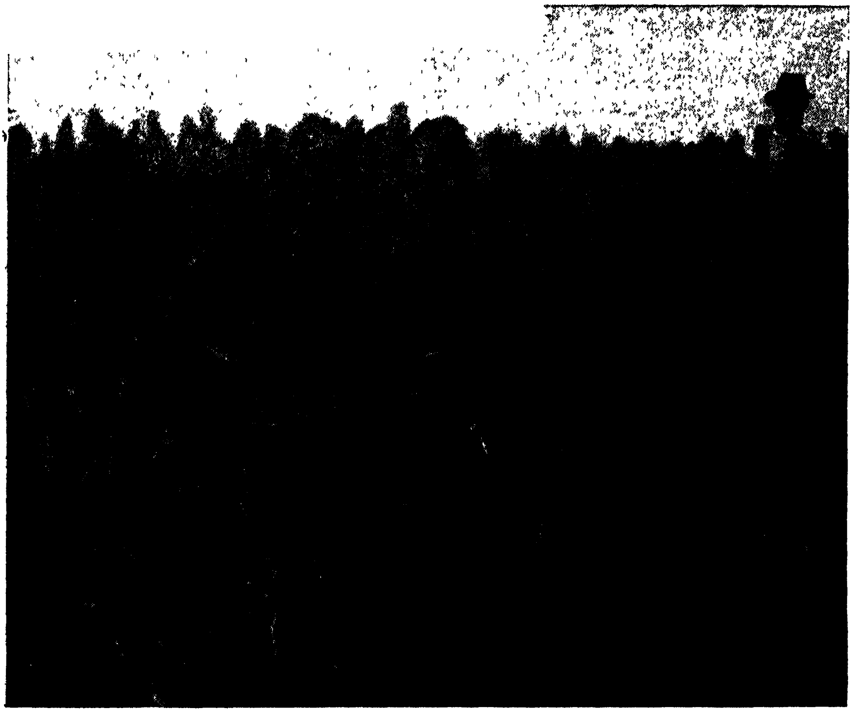


Plate 73.
KALO.—A heavy crop on black soil at Hermitage Regional Experiment Station.

angled and approximately ¼ inch in total length. Glumes are small and straw coloured, often edged with brown. The grain is medium-small, though well grown samples may reach medium size; the grain is plump and rounded and is normally reddish gold in colour. This variety is a prolific producer under good conditions, and it possesses excellent powers of recovery. During dry seasons it can hold out for long periods, and still produce a useful crop from late tillers and stem-branches when rains finally occur. Its stubble is more abundant and more palatable than that of Wheatland, making it popular for grazing subsequent to harvesting. Its main disadvantages are its height, which is sometimes excessive, and its tendency to lodge prior to full maturity. These characteristics seem to be accentuated on scrub soils and on some of the lighter textured alluvials, but are not often of serious account on heavier clay alluvials and the black soils of the Downs. This variety has attained its greatest popularity on the Darling Downs, where it has been grown with great success. It has also been widely distributed throughout central and sub-central Queensland, where it has largely yielded place to Wheatland, and more recently to Early Kalo.

Hegari (Plate 79).

This variety, which is a native of North Africa, is the most variable of our varieties in response to seasonal conditions, sites and planting dates. In the United States it is also described as being especially sensitive to seasonal conditions and varying widely in time of heading,

maturity, height, and yield. In Queensland it is typically tall, ranging from 4 ft. to 5 ft., or even higher under certain conditions. Hegari ranges in maturity from early to late; on the Darling Downs and in the Burnett it is sometimes earlier in its heading (45 days) than either Kalo and Wheatland, while in the Callide Valley it is usually classified as late, heading in 60 to 85 days and maturing in 4½ to 5 months. Under long-season conditions it normally tillers very freely, giving the plants a spreading habit, while under short-season conditions stooling may be greatly suppressed. Foliage is generally quite abundant, drooping, and with midribs mainly cloudy. Heads are irregularly oval in shape and fairly dense, the tight clustering of the grains on short branches providing a "bunch of grapes" effect. Awns are present in this variety but are so minute that the heads normally have a distinctly awnless appearance. Glumes are conspicuously black, and the kernels, which are well exposed, are well rounded, of medium size, and chalky white in colour. This variety, though less popular than Wheatland and Kalo, has given excellent individual yields at scattered centres throughout the grain sorghum belt of Queensland. Its main virtues are its ability (like Kalo) to recover well following rains late in the season and the bulk of feed it provides for grazing. Its main disadvantages are its unpredictable behaviour and its lodging propensities following good growing conditions on fertile scrub soils. Its grain, being relatively soft, is very susceptible to weevil attack and does not normally store as well as that of the coloured varieties.

Early Kalo (Plates 74 and 78).

This variety originated in the United States as a selection from Kalo. The material received in Australia, however, showed definite variability in grain colour and plant habit. Selections were therefore made within

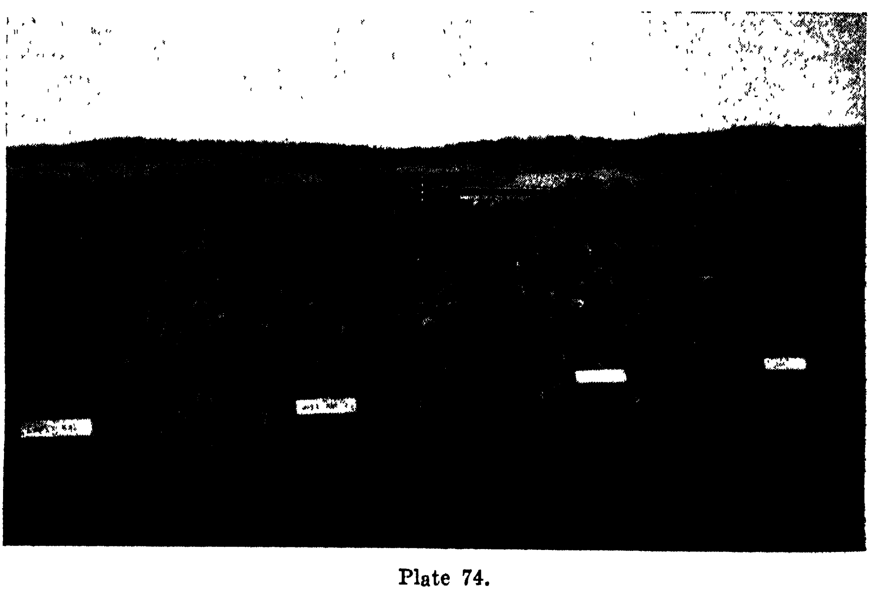


Plate 74.

END VIEW OF FOUR OF THE PLOTS IN A GRAIN SORGHUM VARIETAL TRIAL, HERMITAGE REGIONAL EXPERIMENT STATION, 1949.—Plots from left to right are Early Kalo, Alpha (Wheatland 11s), Caprock, Kalo.

the variety at Biloela in 1942. These were purified and tested over a four-year period, when the best selection was increased and made available for field testing. This variety is clearly a Kalo type, which under some conditions is very difficult to distinguish from standard Kalo until maturity is reached. Normally it is distinctly shorter than Kalo, particularly in Central Queensland, its height ranging from 3 ft to 4 ft. The variety heads in from 40 to 60 days of planting and reaches maturity in 3 to 3½ months. Its foliage is somewhat sparse compared with Kalo, but is otherwise similar, the midrib being cloudy. The variety tillers quite freely when space permits. Stem-branching may be altogether absent or quite pronounced, depending upon the season, but the secondary heads do not vary greatly in height from the primary heads. Heads are similar to those of Kalo, but tend to be somewhat more open and less club-shaped. Awns are present but are generally less than ¼ inch long and are often deciduous at maturity. Glumes are small and straw-coloured and the grain is well rounded, medium-small to medium size, and a rich reddish gold or full red in colour. When grown alongside standard Kalo this variety is readily distinguishable from it at maturity on account of the richer colour of its grain. Early Kalo's main advantages lie in its earliness and its powers of recovery after a check. In good seasons it cannot be expected to compete in yield with Kalo or other later varieties, though it has on occasions produced 60 to 80 bushels per acre. Its earliness makes it a useful variety for drier districts, particularly for early planting (where a quick crop is required) or for late planting (where it is desired to escape frost damage). Though liberated widely only in the Callide Valley, it has also given good results in trials as far south as Warwick.

Alpha (Plates 75 and 77).

This variety, previously known as Wheatland selection 11s, arose from a single plant selection made on the farm of Mr. C. Skinner in the Biloela district in 1944. The resultant row from the seed of this plant was at once impressive, being more prolific and uniform than any of the other Wheatland selections. The strain was purified by pedigree selection, and was first put into yield trials in 1946-47, when it outyielded all standard varieties at the Biloela Regional Experiment Station. In addition it has topped the yields in two successive trials at the Hermitage Regional Experiment Station (near Warwick) and has been given good general field reports. Although this selection is very similar to Wheatland in many respects, it is sufficiently distinct to merit a new name. In height it is very similar to standard Wheatland, but appears less subject to variation; in all tests so far conducted it has been very close to 3 feet tall. Its foliage is very similar to that of Wheatland but is somewhat finer and less harsh; the midrib is cloudy, indicating juiciness in the leaf and stalk. The variety tillers very freely but branches sparsely. In Central Queensland it differs very little from Wheatland in its periods of heading and maturity, but on the Darling Downs it has so far proved some days earlier. The heads are similar in overall shape to those of Wheatland but are more regular and more level on top. Awns are absent, as in Wheatland, and the glumes are normally black to purple-brown. The major difference from Wheatland is in the grain, which is distinctly smaller in size and slightly richer in colour. One of the great advantages of this variety is the regularity of its heading height, in which respect it is much superior to Wheatland. In three years of trial it has proved to possess good

drought resistance and to be easily handled by harvesting machinery. It is offered mainly as a substitute for Wheatland as a midseason variety, particularly in Central Queensland and the Darling Downs.

Plate 75.

ALPHA.—A new Queensland variety, originating as a selection from Wheatland. Alpha has yielded well in trials, and produces its heads at a very uniform level.

Capricorn (Plates 76 and 79).

This is another new variety developed in Queensland, and has resulted from selection within Early Kalo. Known for some seasons as Ex Early Kalo, EK. 7, it has also been subjected to limited testing from Central Queensland to the Darling Downs. It is in the same height range as standard Kalo, ranging from 3 ft. 6 in. to 4 ft. 6 in. In Central Queensland it has normally headed within 60 to 70 days and matured its crop quite uniformly in approximately four months. In the Central Burnett it has been recorded as distinctly early maturing, but in three trials on the Darling Downs during 1948-49 it proved to be later than any of the standard varieties and required a full five months for its maturity. This variety carries a heavy and attractive foliage, which, coupled with its free stooling habit suggests definite possibilities as a dual purpose variety. It is reported that dairy cattle showed marked preference for this variety over all others in a varietal

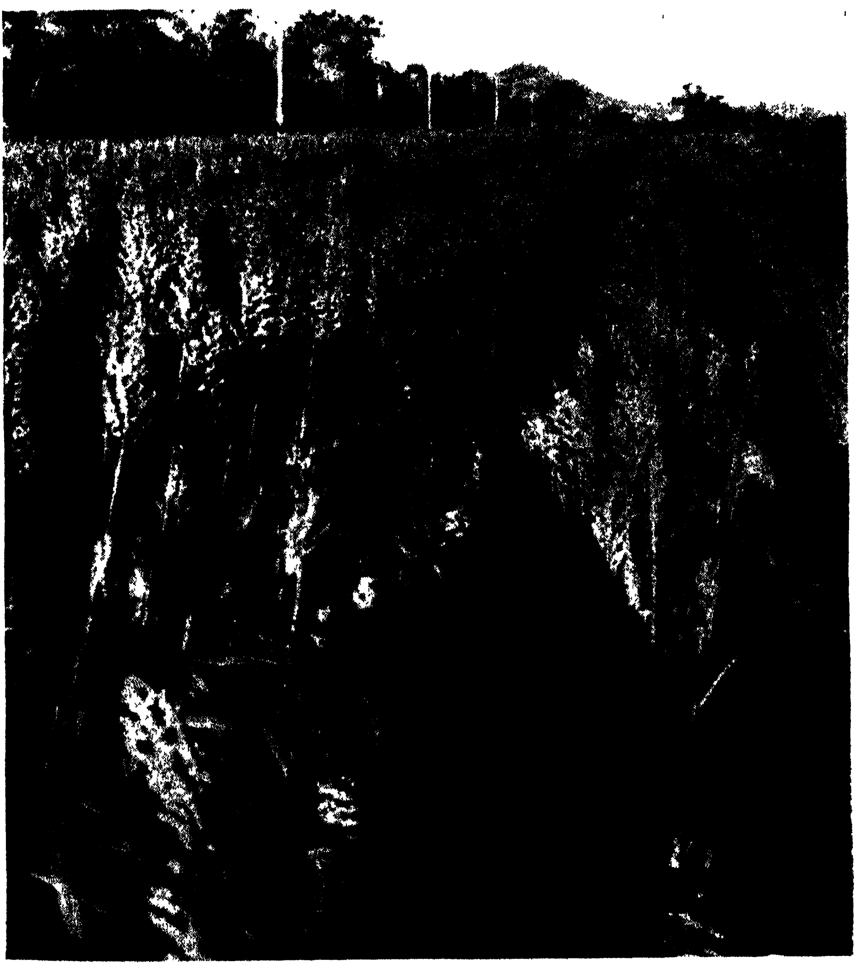


Plate 76.

Capricorn.—A Queensland-bred grain sorghum, originating as a selection from Early Kalo; planted in rows three feet apart on a Central Queensland farm.

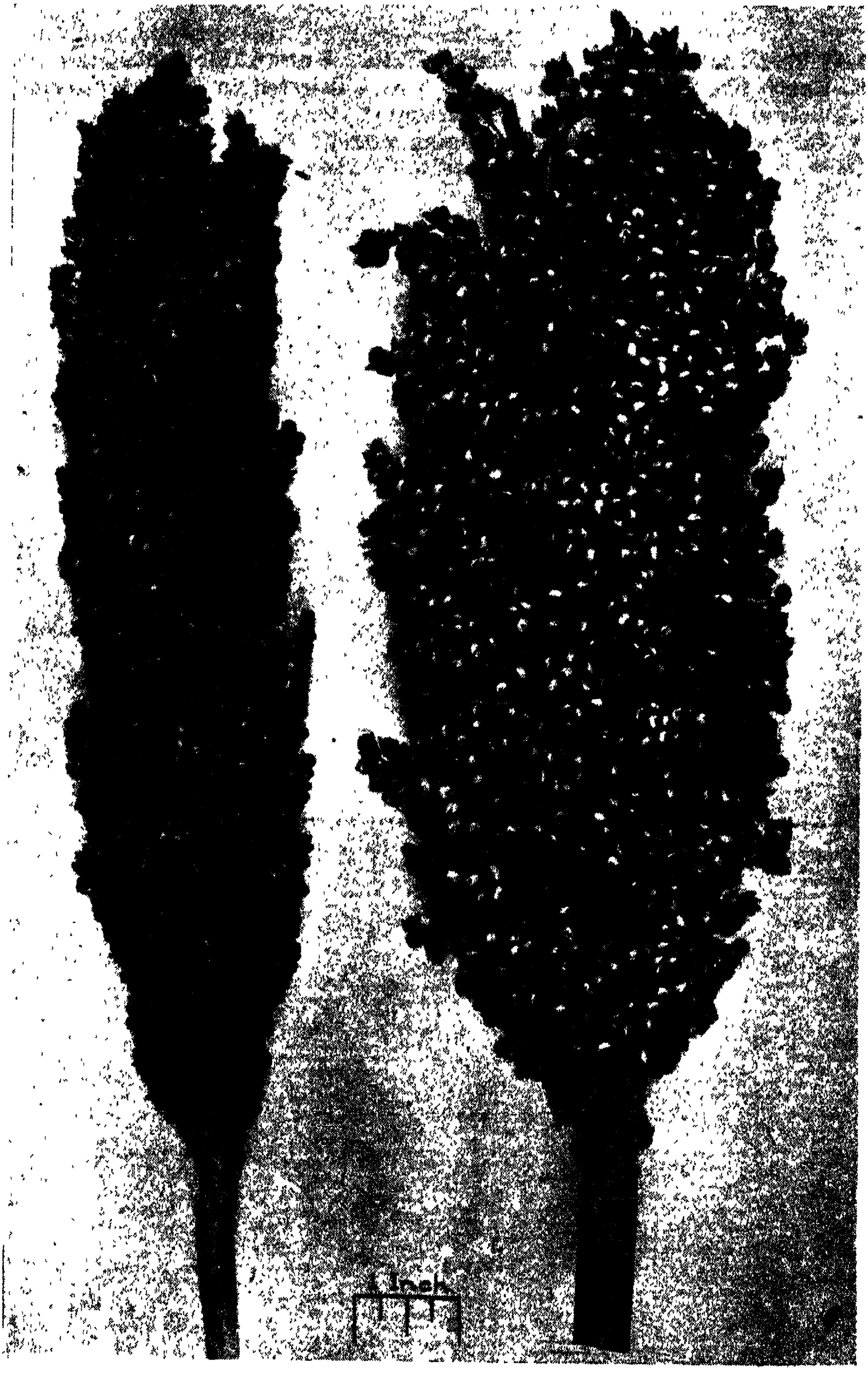


Plate 77.

HEADS OF GRAIN SORGHUM VARIETIES.—Alpha on left; Wheatland on right.

Plate 78.

Heads of Grain Sorghum Varieties.—Early Kalo on left; Kalo on right.

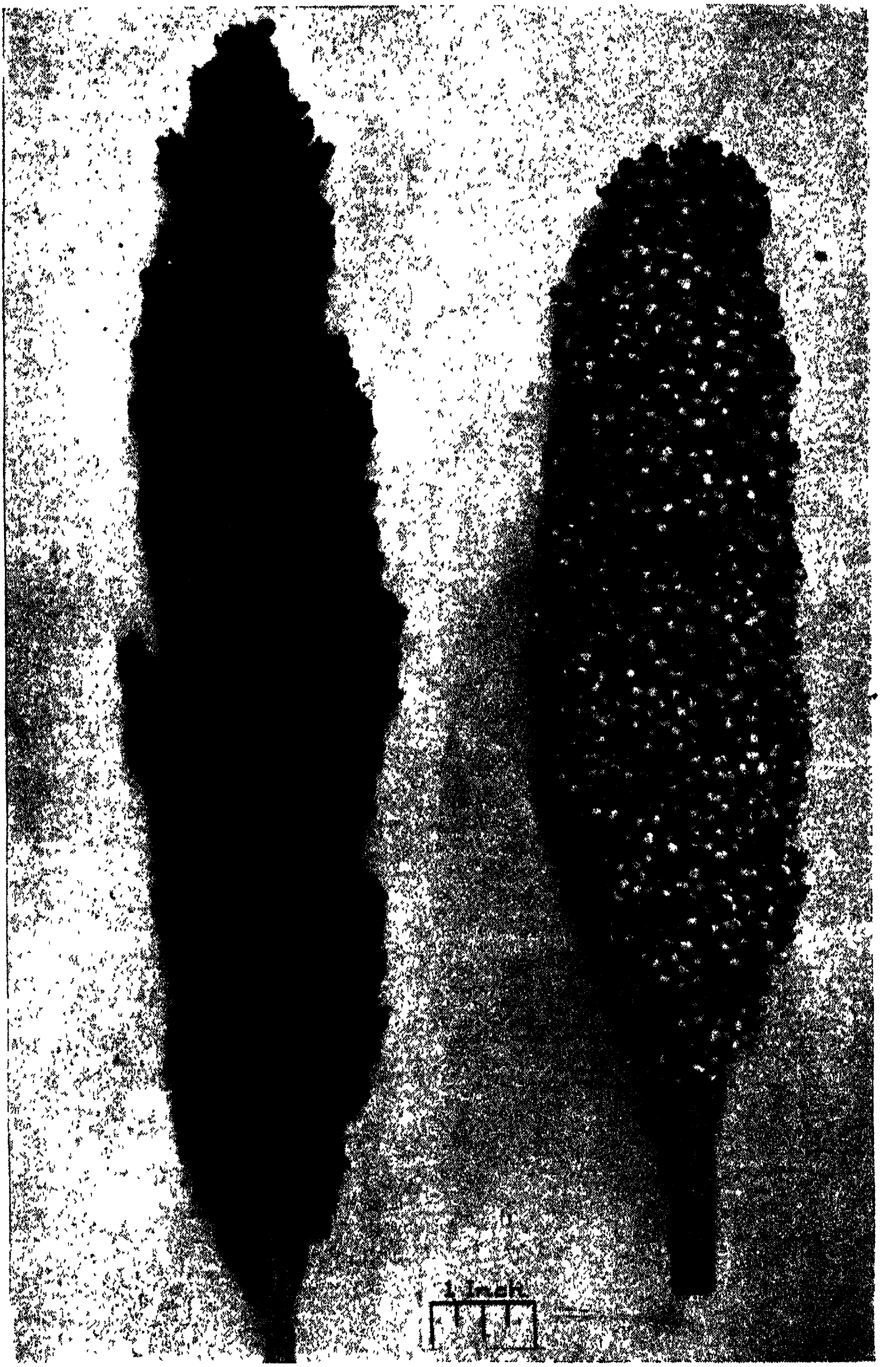


Plate 79.

HEADS OF GRAIN SORGHUM VARIETIES.—Capricorn on left; Hegari on right.

Plate 80.

Heads of Grain Sorghum Varieties.—Caprock on left; Martin on right.

trial in the Central Burnett district which had been ruined for grain purposes by frost. Head shape is very distinct, being more spindle-shaped than club-shaped, and with heads presenting a more open appearance than Kalo; heads vary from quite large, where spacing is wide, to fairly small, where the spacing is close or tillering and stem-branching are heavy. This variety is also distinguishable from the Kalos by the absence of awns, and the dark red colour of the grain, which is darker even than Early Kalo. Glume colour varies from straw-coloured to blotchy and black. While it is still too early to forecast a future for this variety, it can be stated that it has yielded well during indifferent seasons in Central Queensland, and on account of its somewhat open head it may prove more suitable for coastal areas than our standard varieties. Moreover, in its trials at Biloela it produced its heads at a more uniform level than Kalo or Wheatland. Preliminary trials indicate that it may be rather too late on the Darling Downs for use solely as a grain variety, but it may eventually replace varieties like Hegari as a grazing or dual purpose variety.

Coastland.

Though this variety is not available for general distribution, a brief note on its main characteristics may be of interest at this stage. Growers of grain sorghum on the central coast of Queensland have long experienced serious trouble from larvae of the yellow peach moth during the heading stages of the crop. As entomological investigations had indicated that these caterpillars were far less prone to attack open heads than dense or tightly packed heads, a number of selections were made of open-headed types. Some of these selections from Wheatland showed very open heads with drooping branches, which in preliminary tests near Rockhampton showed considerably less caterpillar damage than did standard Wheatland, Kalo or Hegari. These selections previously known as Open Wheatland are now termed Coastland. Twelve strains are being tested in Central Queensland with the object of determining the best and multiplying this up for general use. These strains have a plant structure similar to Wheatland, but normally project their heads higher from the top leaf sheath. They also differ from Wheatland in the possession of the very open head type referred to above, and in the existence of strong awns approximately ⅜ inch long. The grain is very similar to that of Wheatland in shape, size and colouring. Based on past experience this type cannot be recommended for inland districts where hard conditions may well be experienced.

Martin (Plate 80).

This is a relatively new variety from Texas U.S.A., which has been under trial in Queensland since 1945-46. While it has attained considerable favour with certain farmers who have tried it, it cannot be generally recommended until further experience has been obtained in comparison with other varieties. It is a fairly sturdy variety which tillers very sparsely and could probably be planted at a higher rate than that generally recommended for other varieties. It ranges in height from 2 ft. 9 in. to 3 ft. 9 in., being normally a few inches taller than Wheatland under comparable conditions. In Central Queensland it appears to be definitely early maturing, heading in 40 to 50 days and maturing in 3½ to 4 months. On the Darling Downs it behaves as a mid-season variety, but it appears to be about a week earlier than Wheatland throughout. The head is erect, long and somewhat slender,

and is awnless. Glumes are black in colour and enclose the grain rather fully. The grain is large, rounded in shape and reddish brown in colour; it is very similar to Wheatland except for the darker colour. The variety has shown itself capable of good yields under a variety of conditions. In addition, it gives promise of being stronger at the base of the stalk than Kalo, and therefore less susceptible to lodging, and may prove more regular in heading height than Wheatland.

Caprock (Plate 80).

This is another recent introduction from Texas, which was officially tested for the first time in Queensland in 1948-49. It appears typically a late maturing variety of a strong stocky habit of growth and with heavy broad foliage. In height it has ranged from 3 ft. to 3 ft. 9 in., but is not so regular as Alpha, Capricorn or even Kalo in this respect. Heads are fairly dense in texture and are heavily awned. The grain is medium-large to large and is a rich reddish-gold or red, being distinctly brighter in colour than Martin or Kalo and comparable in this respect with Early Kalo. This variety has, during one season's testing, given evidence of its ability to yield well under reasonably good growing conditions. Its habit of growth and its relatively late maturity, however, suggest that it may be better adapted to good soils and good rainfalls than to poorer or drier conditions.

Plainsman.

This variety, like Caprock and Martin, is a recent introduction to Australia from Texas. An American report describes it as a double-dwarf variety which bears a thick stout stalk and tillers slightly. The heads are fairly long, cylindrical, and dense, and are prominently awned. Grain colour is a rich red, like that of Caprock, but the glumes are blackish rather than straw-coloured. Under Texas conditions the variety matures 10 days later than Martin and five days earlier than Caprock. Plainsman and Caprock both originated from the same cross, and are very similar in their general appearance; the main difference between them lies apparently in their periods of heading and maturity.

[TO BE CONTINUED.]

DAIRY BULL FREIGHT REBATES.

The Minister for Agriculture and Stock (Hon. H. H. Collins, M.L.A.) has announced that an Interstate Sire Subsidy Scheme has been approved as one of the projects to be financed from the grant made available by the Commonwealth Government for improving efficiency in the dairying industry.

The position therefore is that, in addition to the rebate on rail freight within the State which has been granted for some years under the State Dairy Cattle Improvement Rebate Scheme, rail freight incurred in other States may now be refunded up to a maximum of £15 per bull on a limited number of bulls railed from these States to Queensland.

To be eligible for this rail freight rebate, a bull must be the progeny of a cow which has qualified for entry into the Advanced Register of a Dairy Cattle Herd Book Society. Application forms are available from the Department of Agriculture and Stock, Brisbane.

The conditions governing the new scheme are similar to those relating to the existing State scheme.

Hybrid Maize—A Progress Report.

W. W. BRYAN, Queensland Agricultural High School and College, Lawes.*

LAST year certified hybrid maize seed was on sale in Queensland for the first time, but only approximately 300 bushels were available and this quantity was sold immediately certification was completed. This year it is expected that at least four times this quantity of seed will be available and it is in the interests of intending buyers that they should clearly understand both the advantages and shortcomings of this material.

The aims in breeding hybrid maize for south-eastern Queensland were higher yield of sound grain and a good plant type that would be fairly resistant to insects, diseases, heat and wind. In general, these aims have been achieved and in addition the type of hybrid produced shows remarkable uniformity in plant type and in ears and grain. While no selection for show type has been made in the breeding programme, hybrids have been successful in winning championships at a number of shows, including Toowoomba, during the last 12 months. On the average yield of 26 bushels per acre for south-eastern Queensland, an increase of approximately four bushels per acre has been gained, and this percentage increase is maintained in better seasons when yields are higher, e.g., on a 78-bushel crop nearly 12 bushels per acre extra grain can be expected.

Seed Certification.

A brief review of the composition of hybrid maize may not be amiss. Hybrid maize is a combination of four different inbred lines. These lines are first combined in pairs to form single crosses or "Foundation Hybrids," this work being done at the Queensland Agricultural College, Lawes. A pair of single crosses is then combined, and this part of the work is carried out by private growers under very strict supervision. The resultant seed for use by ordinary maize growers is sold only if it has met all the requirements of hybrid maize seed certification.

In brief, the certification programme of the Queensland Department of Agriculture and Stock requires the following:—

(a) The area on which the seed crop is to be grown must be registered. The site must be approved by a seed certification officer as being suitable for the crop, as not having grown a maize crop during the previous season, thus disposing of the danger of volunteer plants, and as being likely to be sufficiently isolated at flowering time.

(*b*) At flowering there must be no other maize within a quarter of a mile which is shedding pollen while receptive silks are present on the female or ear parent of the cross.

(*c*) The single cross chosen as the ear parent must be thoroughly detasselled at flowering time, all tassels from these plants being removed before they have shed any pollen.

(*d*) The harvesting of the crossed seed, its shelling and bagging must be done under the close supervision of a seed certification officer, who seals the bags as they come from the sheller. When an official seed test for physical purity and germination has been passed, the bags are labelled with official labels and the seed is available for sale by the seed producer.

* In collaboration with C. C. F. Bourne, E. U. A. McCarthy and L. T. Petersen.

All seed is sold in officially sealed and labelled bags and no seed can be offered for sale in Queensland as hybrid maize seed unless it is officially certified.

Each Hybrid is Individual.

Many different inbred lines have been bred and many different combinations of four inbreds are therefore possible. Each hybrid is thus strictly individual. The importance of this cannot be over-emphasised. A good illustration is supplied by the two hybrids Q462

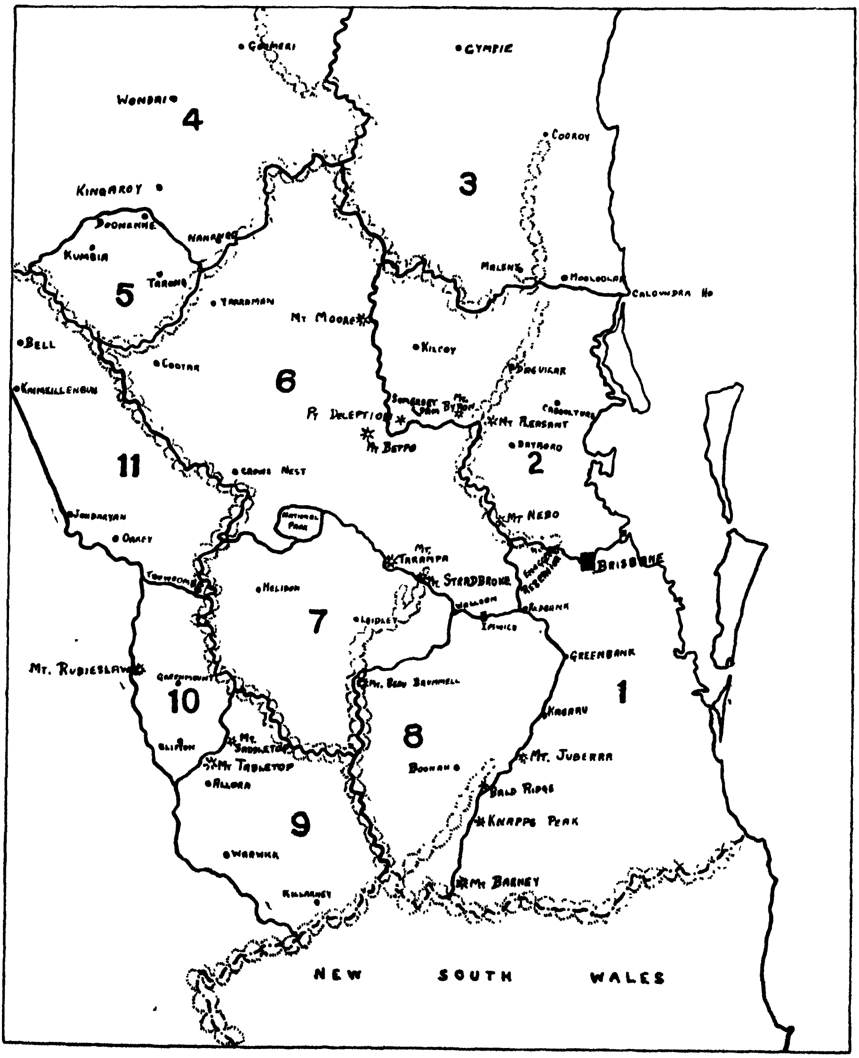


Plate 81.

Sketch Map of South-eastern Queensland Sowing Zones in which Different Maize-growing Conditions are Experienced.

and Q629, which differ in only one inbred line; thus if Q462 is composed of the inbreds A, B, C, D, Q629 would consist of A, B, C, Y. In Zone 1, Q629 is 2.5 per cent. *better* than Q462, while in Zone 7 Q629 is 14.7 per cent. *worse* than Q462. Such findings are not uncommon. Each hybrid must therefore be tested for performance in different districts to determine its suitability.

Testing of Hybrids.

For the protection of maize growers, before any Queensland hybrid can be certified it is thoroughly tested in the various regions of south-eastern Queensland which have been determined as providing different growing conditions. South-eastern Queensland has been divided into four regions and each region subdivided into zones as shown in the accompanying map (Plate 81).

Region I.	..	Coastal Moreton	.. Zones 1, 2, 3.
Region II.	..	South Burnett	. Zones 4, 5.
Region III.	..	West Moreton	.. Zones 6, 7, 8.
Region IV.	..	Darling Downs	.. Zones 9, 10, 11.

This map shows the sub-division of south-eastern Queensland that has been made on the basis of growing conditions, soil types and the reaction of various maize strains in different areas. Some of the boundaries between zones are somewhat arbitrary and are likely to be subject to minor alteration, but essentially the 11 zones represent areas where different maize growing conditions exist. It was hoped that it might be possible to produce hybrids which would be successful over the whole of south-eastern Queensland, but so far this has not been achieved. However, as more hybrids are bred it may be possible to approach this ideal more closely. It is known that some hybrids are more widely adapted than others, as can be seen from Table 1. This state of affairs also exists with the old standard varieties, none of which is completely suited to the whole of south-eastern Queensland.

A hybrid will be recommended for a particular zone or zones, the requirement being that to merit certification for a zone the hybrid must—

(*a*) Outyield the average of the better open-pollinated varieties by a specific percentage, testing to be carried out in official yield trials over a period of at least three seasons.

(*b*) Compare favourably with local varieties as far as sound field characters are concerned.

(*c*) Have no characteristics which make it unprofitable or undesirable for the locality for which it is officially recommended.

Certified seed of eight hybrids is at present being produced. The performance record of these hybrids in official trials at a large number of centres in south-eastern Queensland over the past 10 years is shown in Table 1. In this table the top line of each cell indicates the percentage increase of hybrid over standard varieties, and the bottom line gives the number of seasons over which the hybrid has been tested in each zone. The number of actual trials is generally greater than the number of seasons, as in most zones more than one trial site is used annually.

TABLE I.

PRODUCTION RECORDS OF MAIZE HYBRIDS.

Hybrid.	Zones.								
	1	3	4	5	7	8	9	10	11
				5½ to 6 months maturity.					
Q23 ..	16·9% * 3	−4·7% 1	21·4% * 7	13·6% * 2	24·7% * 3	−11·2% 1	.. ..	7·0% 1	.. ..
Q431 ..	14·3% 2	8·3% 1	18·8% * 5	.. ..	21·4% * 3	.. ..	.. ..	.. ..	.. .
Q499 ..	29·5% 1	18·0% 1	12·5% 4	6·9% 3	16·6% * 7	.. ..	.. .	.. ..	.. ..
Q629 ..	17·8% * 5	−6·2% 1	16·2% * 8	18·4% * 3	8·3% 4	12·1 2	.. ..	.. .	.. ..
Q692 ..	7·1% 2	.. ..	20·4% * 6	11·2% 3	−9·2% 1	.. ..	.. ..	.. ..	.. ..
				5 months maturity.					
Q716 ..	.. ..	.. ..	16·9% * 3	−7·4% 1	25·8% * 6	15·7% * 5	18·7% * 2	10·1% 5	8·8% 4
Q717 ..	.. ..	.. ..	1·6% 3	8·8% 2	29·0% * 3	11·3% 5	.. ..	12·4% 1	11·5% 2
Q739 ..	.. ..	.. ..	25·2% * 3	−6·3% 2	14·4% 4	1·1% 3	15·9% * 3	8·3% 1	17·4% * 4

An asterisk (*) in any cell of this table indicates that the particular hybrid is officially recommended for that zone.

No trials have yet been finalised in zones 2 and 6.

Production of Hybrid Maize Seed.

Producers of hybrid maize seed are divided into two groups:—

(*a*) Home producers—those growers who intend to produce seed wholly for their own use and do not intend to offer their crop for sale. This seed is not certified.

(*b*) Commercial growers—those growers whose intention is to offer their seed crop for sale as certified hybrid maize seed.

All intending producers of hybrid maize seed must serve a probationary period of one growing season before they are allowed to produce seed commercially. There are two reasons for this—one, to allow the grower to learn the job of hybrid maize seed production, and the other, to satisfy the certification authorities that he has the knowledge and equipment to carry out the programme efficiently.

During the 1945-46 season the first probationary crossing plot was successfully completed. This was the only plot grown during the season.

The 1946-47 season saw an increase in probationary plots to three, one of which was condemned. No commercial or home producer plots were planted. For the next season (1947-48) the number of probationary growers who planted increased to 10, three of whom lost their plots due to seasonal conditions and one of whom had his plot condemned. Two commercial growers planted a total area of 13 acres with a yield of 306½ bushels of seed. The hybrids produced were Q23, Q431, Q629, and Q716.

Last season (1948-49) nine probationary plots were planted, one being lost due to bad conditions and one condemned. These plots have not yet been finalised. There were two home producers and seven commercial producers. A total area of 54 acres was planted for commercial seed production, this being an increase of 41 acres over the previous season.

Next season it is anticipated that 17 growers will undertake probationary plots and that certified seed will be produced by 15 growers planting a total area of 165 acres, three times that of the previous season.

Seed Sources.

1948-49 Commercial Growers are listed hereunder:—

Name and Address of Grower.	Hybrid.	Period of Maturity.	Recommended Zones.
David Young and Sons, Seed Merchants, Box 53, P.O., Kingaroy	Q23 Q431 Q739	Late Late Mid-season	1, 4, 5, 7 4, 7 4, 9, 11
A. W. Bachmann, Roadside, Mulgowie	Q716	Mid-season	4, 7, 8, 9
W. A. Bateman, Flagstone Creek, *via* Helidon	Q717	Mid-season	7
D. E. Poulsen, Roadside Box 460, Cooroy	Q499	Late	7
H. T. Tommerup, Central Kerry, *via* Beaudesert	Q629	Late	1, 4, 5
R. C. Andrews, Booie road, *via* Nanango	Q692	Late	4

Any maize grower interested in purchasing hybrid maize seed should contact a seed producer direct. Seed will be available in ½, 1 and 3 bushel lots, the price being £3 per bushel. Seed stocks of some of the hybrids may soon be exhausted.

Generally speaking, these hybrids should be suitable for the following regions:—

Region.	Suitable Hybrid.
Coastal Moreton	Q23, Q431, Q629 (late maturing)
South Burnett	Q23, Q431, Q629, Q692 (late maturing), Q716 (mid-season)
West Moreton	Q23, Q431, Q499 (late maturing), Q716, Q717 (mid-season)
Darling Downs	Q716, Q739 (mid-season)

Buyers are warned that the Regulations under the Seeds Acts provide the following:—

NO PERSON SHALL SELL ANY MAIZE SEED FOR SOWING AS HYBRID MAIZE SEED UNLESS SUCH SEED IS CERTIFIED AS HYBRID MAIZE SEED.

APPLIED BOTANY

Weir Vine—A Declared Noxious Plant.

C. T. WHITE, Government Botanist.

WEIR vine (*Ipomaea calobra*) has been declared a noxious weed throughout the area of every Local Authority in Queensland and the following description and illustrations are offered to aid in the recognition of the plant.

Description.

Weir vine is a vigorous, summer-growing, creeping plant sending out long leafy runners over the ground from a large central crown. It produces large, underground, sweet-potato-like tubers. The leaves are on long stalks, somewhat heart-shaped and fairly large (up to 4 inches across). The flowers are of a typical convolvulus or morning glory type and are borne in clusters on stalks about as long as the leaves. They are about 3 inches long and change from pinkish-red to blue. The seed capsules are of a roundish egg-shape, $\frac{3}{4}$-1 inch across, and bear several blackish angular seeds.

Distribution.

The vine is confined to Queensland and finds its greatest development on the hard red soils carrying mulga and ironbark in the Maranoa district.

Local Names.

According to its discoverer, Walter Hill, first Director of the Brisbane Botanic Gardens, it was known to the natives on the Barcoo as Calobra. "Weir" or "Gueeah" seems to have been the name in the Maranoa country and weir vine has held as the popular name to the present day.

Properties.

The green plant is poisonous to stock, especially sheep. In feeding tests, initial symptoms were produced within 30 days. The animals lost condition and carried their heads unusually high, with the ears well back; their backs were arched and there was some inco-ordination of gait. From a study of advanced field cases it seems there are a number of functional disturbances of some of the finer adjustment centres of the brain. The animal urinates copiously and frequently. It staggers badly when walking, the hind legs being straddled, apparently in an effort to maintain balance, and the sheep seems no longer able to judge the kind of obstacle it encounters when walking through yards or timbered country. It is not uncommon to see affected sheep pushing against rails, trees or fences and making little effort to go around them. When this stage is reached, the animal usually dies fairly soon, either from accident or apparently as a result of the weir vine poisoning. No poisonous principle has yet been isolated.

Plate 82.

Uses.

The large, watery, underground tubers were reputed to be eaten by the aborigines. An "arrowroot" flour has been made from them by local residents and the plant has been thought of as a source of commercial mucilage for industrial purposes, but the tubers are low in starch content and their collection and treatment is hardly likely to be practicable.

Eradication.

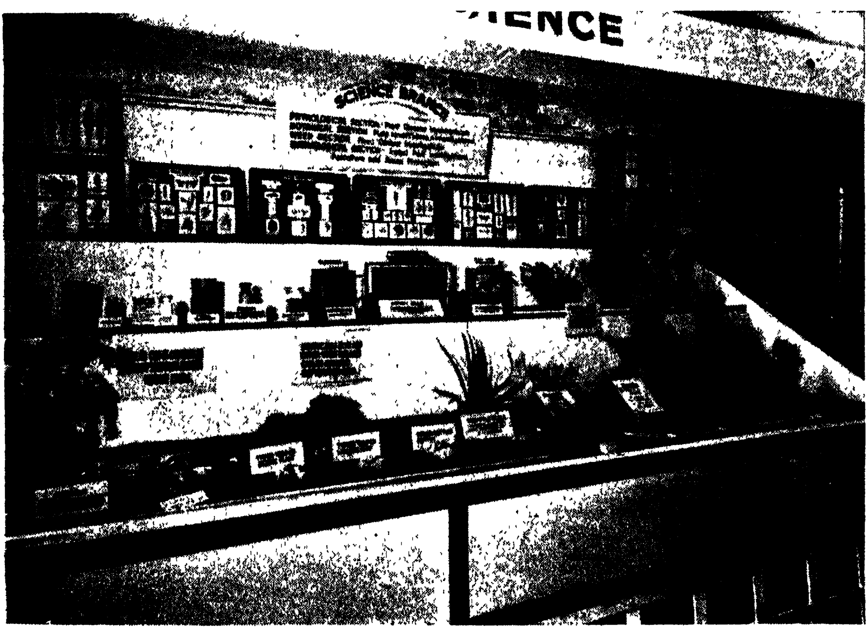
The Biological Section of the Lands Department has carried out investigations into the eradication of this plant and has reported that hormone-type weedkillers can be used successfully against this plant in concentrations of 0.1 per cent. 2, 4-D. The solution is best applied by spraying the vines when they are growing vigorously and about half-grown. A kill of 95 per cent. of plants averaging 646 to the acre has been achieved, using an average of 36 gallons of solution to the acre.

By chopping off the top growth just below ground-level with a mattock and pouring a small quantity of arsenic pentoxide solution mixed at 1 lb. to 1 gallon of water on the exposed damaged crown, a complete kill is obtained. This operation is simply and quickly carried out but is considerably more costly than spraying with the hormone weedkillers.

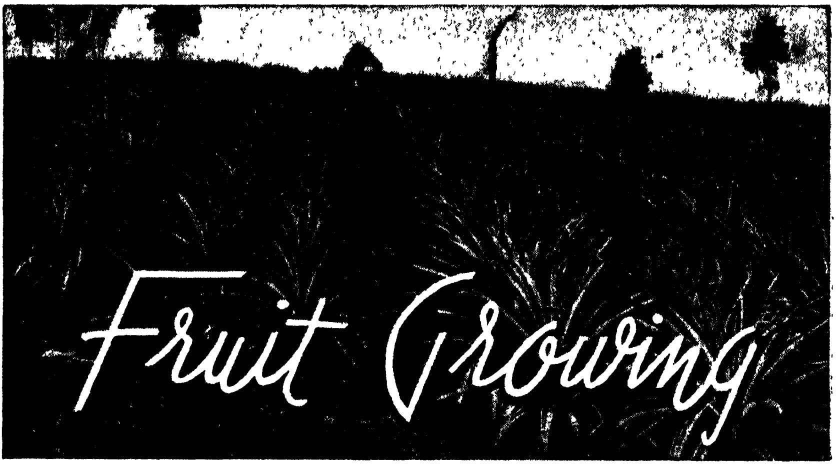
DESCRIPTION OF PLATE 82.

Weir Vine.

A, Base of corolla laid open to show stamens. B, Capsule. C, Seeds.



Pests and Diseases.—The main features of the Science Branch display at the Brisbane Show were the control of potato diseases, the use of hormone-type weedicides, and life-history cases of important insect pests.



The Origin of the Ellendale Mandarin and Its Relatives.

A. A. ROSS, Horticulturist.

THE origin of citrus varieties is not always easy to trace. Some mandarins have been propagated in Queensland from seedling trees with desirable characteristics. Two of these, the Ellendale and the Solid Scarlet, are grown fairly extensively and the following information is based on data supplied by Mr. Randal Burgess, formerly of Ellendale Orchard and now living in retirement at Traveston on the Burrum River.

Some time prior to 1870, a penal settlement was established at Baffle Creek, approximately 25 miles north of Bundaberg. Captain Walker, who traded with the schooner "Iona" between Baffle Creek and the ports of Bundaberg and Maryborough, owned a piece of land on the banks of the Burrum River in the vicinity of the present railway bridge. Mandarin and orange trees were grown at Baffle Creek by convicts to produce fruit for the settlement, and somewhere about the year 1878 Captain Walker obtained seed from fruit grown there and planted it at Burrum. Mr. E. A. Burgess purchased several of the resultant seedlings and established them on his property lower down the Burrum River. One of these seedlings produced a good quality, large, late mandarin (Plate 83), which was named "Ellendale" after the property. Mr. A. H. Benson, a former Director of Fruit Culture in Queensland, recognised the potentialities of this new variety and made arrangements for its propagation on the Blackall Range.

The original Ellendale tree continued to grow vigorously and showed no signs of disease until 1936, when it was cut out to permit the replanting of the orchard. The tree possessed two disadvantages shown by the majority of its progeny. These are, first, a tendency to split at a fork when the tree carries a heavy crop of fruit (Plate 84), and second, a tendency to skin cracking across the base of the fruit at all stages of development. In spite of these defects, the Ellendale mandarin is grown extensively in Queensland, and it is the main late-season variety

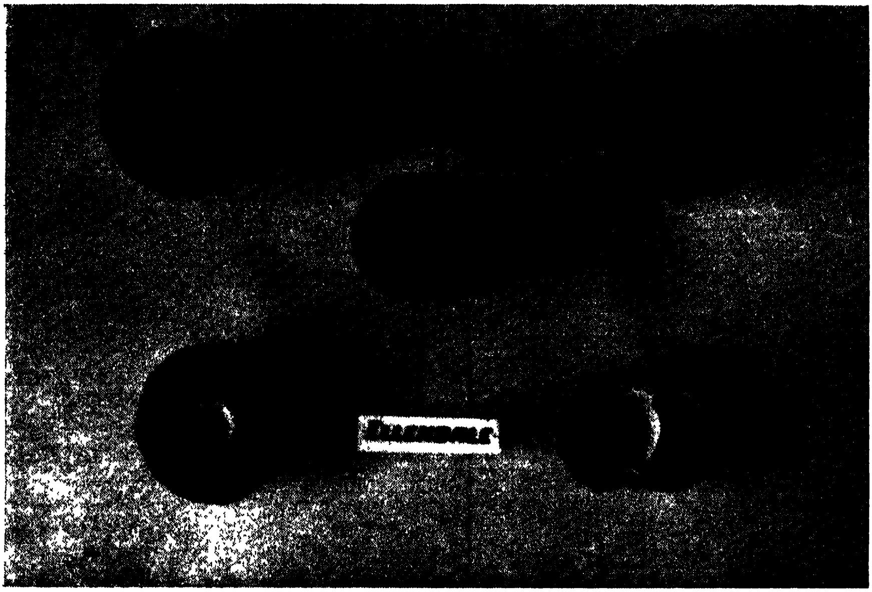


Plate 83.

Ellendale Mandarin.—Note navel development on stylar end. Approximately equal numbers of navel and plain fruits are carried on the same tree.

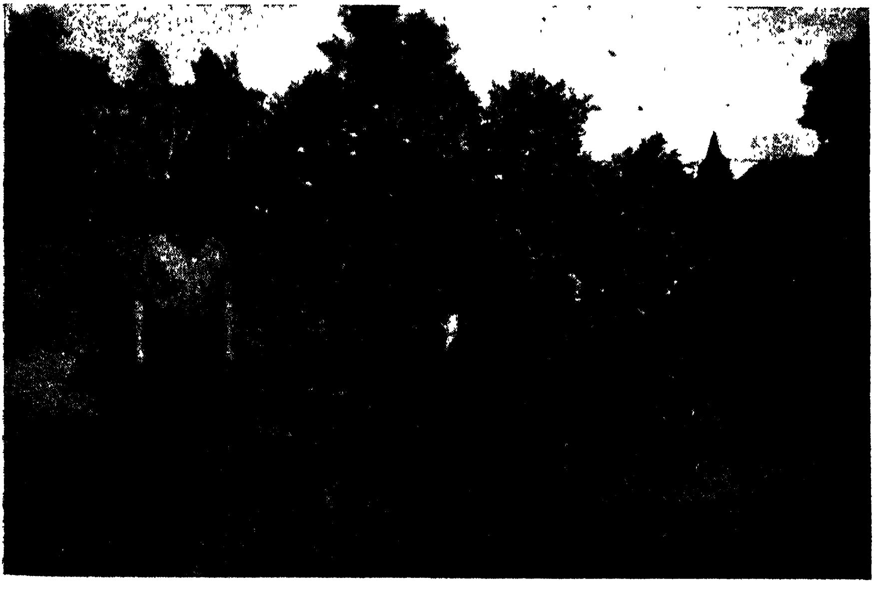


Plate 84.

Ellendale Mandarin Tree.—Showing splitting of the main trunk at the crotch.

in the Gayndah district, where it develops a large, extremely firm, full-flavoured and attractive looking fruit. The crop matures early in July and will hang on the tree under normal conditions until August. The Ellendale mandarin sells particularly well in the southern markets and may be of value for the export trade.

About 1908, Mr. Randal Burgess, a son of Mr. E. A. Burgess, raised a number of open-pollinated seedlings from the Ellendale mandarin and produced a wide range of types, most of which showed no prospect of being worthwhile commercial varieties. However, two of the best seedlings were selected and became known as Pride of Ellendale and Burgess Scarlet. The latter was later renamed Solid Scarlet.

Fruit of both varieties is inferior to the original Ellendale mandarin. The Solid Scarlet, however, thrives better than the parent Ellendale in the Howard-Burrum district, where it crops consistently and produces fairly large fruit of good quality which hang well on the tree. It matures slightly later than the more widely grown Emperor and so enables the mandarin harvesting season in the Howard-Burrum district to be extended. The use of the name Solid Scarlet is unfortunate, as it suggests a relationship between this mandarin and the somewhat raggy, puffy variety called Scarlet. In view of the history and derivation of the Solid Scarlet mandarin, a more appropriate name would be Burgess.

PINEAPPLE FARMING.—The principles of good pineapple farming—selection of the best planting material; correct fertilizing; efficient soil management; careful handling of fruit for market—were illustrated by the Horticulture Branch in its exhibit at the Brisbane Show.

American Foul Brood of Bees.

C. R. R. ROFF, Apiaries Inspector, Science Branch.

FOR the first time since 1931 American foul brood was found in two Queensland apiaries in 1949. This disease is the most serious of those affecting bees, and is responsible for losses in the beekeeping industry in many parts of the world. Economic management of bees is not possible in an infected apiary; however, the chances of serious losses are considerably reduced if beekeepers are familiar with the symptoms and with the correct procedure for dealing with an outbreak of the disease.

The causal organism of American foul brood is a bacterium (*Bacillus larvae*) which, under suitable conditions, multiplies very rapidly. It is able to form resting bodies or spores which may remain viable and infective for long periods and are resistant to moderate heat and disinfection. The most common methods of spreading these spores is the utilisation of infected honey by nurse bees and by the transfer of infected brood combs. The disease may also be transmitted by contaminated beekeeping equipment and the drifting of bees from diseased to healthy hives.

Features of the Disease.

(1) Larvae of all three castes are susceptible, and infection takes place only during the larval feeding period. Death occurs invariably after the capping of cells, when the insects are still in the late larval or early pupal stages.

(2) Larvae are susceptible to infection in all seasons, and an outbreak of the disease may appear irrespective of the quantity of food available.

(3) All races of honey bees are equally susceptible to American foul brood.

(4) Infected honey is not injurious to humans.

Symptoms.

(1) The colony is noticeably weak.

(2) The brood comb has an irregular appearance. In healthy brood the cappings are slightly convex, but where death has occurred they become concave or sunken and may be perforated. In addition, capped cells are somewhat scattered, giving what is often termed a pepper-box appearance (Plates 85 and 86).

Plate 85.

Brood comb infected with American foul brood, showing the irregular distribution of capped cells.

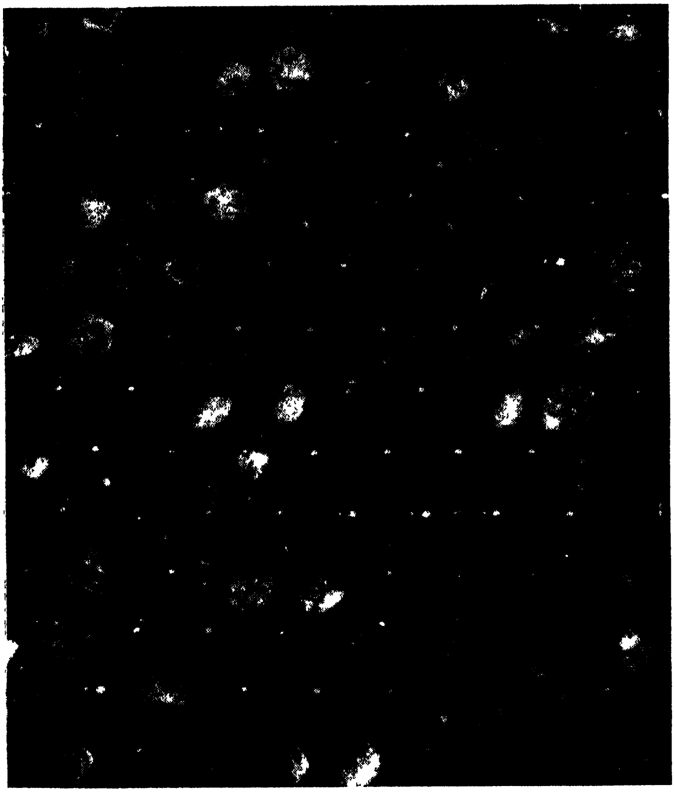


Plate 86.

Portion of infected brood comb, slightly enlarged, showing sunken and perforated cappings.

(3) Diseased larvae or prepupae are at first slightly yellowish in colour, but as decomposition advances they gradually change to brown. The dead larvae are usually extended lengthwise in the cells.

(4) The decaying contents of a cell may, before drying, be drawn out with a wooden match or a splinter of wood into fine, gluelike, ropy threads. In drying a tough dark-brown or coffee-coloured scale is formed which the bees cannot remove. This may be seen extended along the lower side walls when the comb is held so that sunlight falls on the side and lower walls of the cell.

(5) Where death has occurred after pupation a partly developed "tongue" may protrude as a fine thread upwards and backwards from the scale, sometimes adhering to the upper wall of the cell.

(6) The odour in an infected hive may become heavy and foetid, and has been likened to that of stale glue.

Preventive Measures.

The following measures for preventing the appearance and spread of American foul brood are recognised as sound:—

(1) The interchange of brood combs between hives and apiaries should be reduced to a minimum.

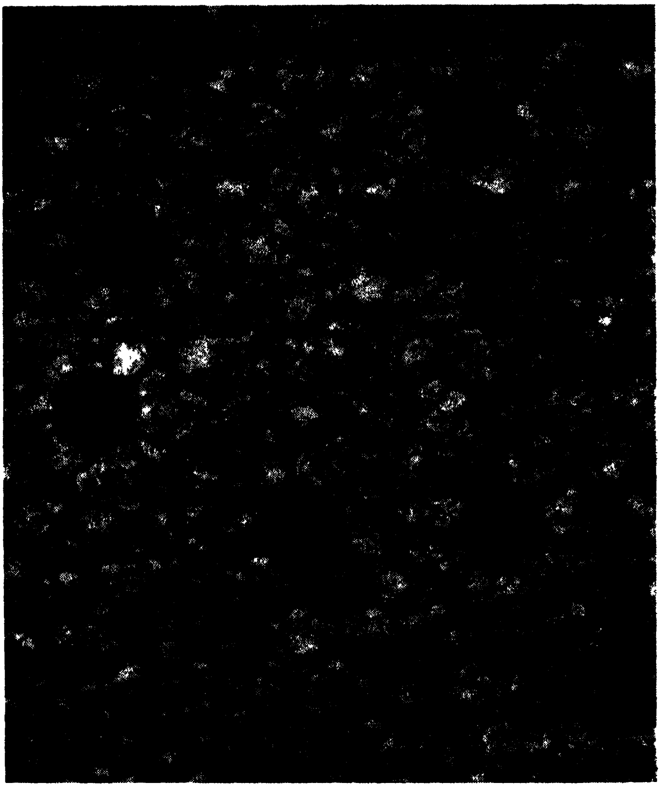


Plate 87.

Portion of healthy brood comb, slightly enlarged, showing compact and normal convex cappings.

(2) Any manipulations or activities which induce robbing should be avoided.

(3) Second-hand bee equipment should not be bought.

(4) Honey from an unknown source should never be fed to bees.

(5) If second-hand honey tins are used great care should be exercised to ensure that the bees do not have access to them.

Treatment of Infected Colonies.

All contents of diseased hives should be burnt and the hives themselves decontaminated according to the following method, which is the safest and most economical:—

(*a*) The destruction of diseased colonies should take place in the evening when all bees are in the hives.

(*b*) Dig a pit of a size suitable for the number of colonies to be destroyed.

(*c*) Kill all bees in the diseased hives with calcium cyanide; about two teaspoonfuls of the poisonous powder should be put through the entrance of each hive before closing it. *Extreme care should be taken*

to avoid inhaling the poisonous gas given off by the cyanide. If calcium cyanide is not readily available the hive entrance should be closed, a pint of petrol sprinkled over the top frames, and the top cover replaced.

(*d*) Build a fire in the pit and, as soon as it is burning well, add the dead bees and combs. The only parts of the hives not to be burnt are the bottom boards, the hive bodies of the brood nests, the bodies of the extracting supers, and the top covers.

(*e*) Scrape the inside surfaces of the unburnt parts of the hives and burn the debris.

(*f*) After all diseased material has been burnt spade the ground down, refill the pit, and pack well.

(*g*) Sterilize the undestroyed, contaminated hives and hive parts by either boiling for half an hour in 1 per cent. caustic soda solution or scorching to a dark-brown colour with a blow torch all the inner surfaces and edges.

Legislative Requirement.

Under "*The Apiaries Act of* 1947" it is provided that any beekeeper in whose apiary any disease appears shall immediately notify, in writing, the Under Secretary, Department of Agriculture and Stock, Brisbane.

Irrespective of the legal requirements, any beekeeper who notices unusual brood symptoms in his apiary should, for his own sake, communicate promptly with the Department in order that assistance may be rendered in treating the infection.

THE COMMITTEE OF DIRECTION OF FRUIT MARKETING.

The following representatives elected by the various Sectional Group Committees, together with Mr. H. S. Hunter, Director of Marketing, have been appointed by the Minister for Agriculture and Stock (Hon. H. H. Collins) to be members of The Committee of Direction of Fruit Marketing for the period until 31st August, 1952:—

BANANA GROUP: W. J. Branch (Russell Island) and E. J. Coghlan (Burleigh Heads).

PINEAPPLE GROUP: H. S. Franks (Wamuran) and J. R. Stocks (Dundowran, via Nikenbah).

CITRUS GROUP: J. A. Kidd (North Tamborine) and J. R. Perkins (Flaxton).

OTHER FRUITS GROUP: J. H. Kidd (Redland Bay) and P. J. Savage (Brookfield).

DECIDUOUS GROUP: N. A. Collins (Glen Aplin) and H. E. Phillips (Thulimbah).

VEGETABLE GROUP: W. J. Beattie (Lagoon Pocket) and A. E. Newman (Rockhampton).

Queensland Cheese Production, 1948-1949.

Compiled by Officers of the Division of Dairying.

AS was predicted last year, production of cheese in Queensland has shown a further decline. The factors tending to bring about this decline, however, were countered to some extent by the favourable seasonal conditions experienced during the greater part of the year. The actual production was 21,033,063 lb. (green weight), compared with 21,595,525 lb. last year.

The following table shows how production has varied over the last 10 years:—

	Tons.		Tons.
1939-1940	6,179	1944-1945	10,017
1940-1941	5,237	1945-1946	12,028
1941-1942	7,292	1946-1947 (Dry Year)..	7,720
1942-1943	12,730	1947-1948	9,641
1943-1944	10,733	1948-1949	9,390

Grading.

A total of 13,485,996 lb. of cheese was graded during the year. After allowing for shrinkage, this represents approximately 67 per cent. of the quantity manufactured, though, of course, some of the cheese graded would have been made during the latter part of the previous year. The official gradings, though they represent only a proportion of the cheese made, nevertheless indicate the trend in quality.

It is pleasing to note that the figures show a substantial improvement as compared with last year's figures, even though they fall somewhat short of the figures for 1946-1947. Grading figures for the past four years are as follows:—

Year.	Choice and First.	Second.	Third.
	Per cent.	Per cent.	Per cent.
1945–1946	70·27	28·28	1·45
1946–1947	72·19	25·88	1·93
1947–1948	63·00	34·40	2·44
1948–1949	71·47	27·61	·92

The proportion of cheese which was classified as Third Grade is probably the lowest ever recorded.

The quality of Queensland cheese compares very favourably with that produced in other States, but a note of warning against complacency must be sounded. Although markets appear very secure for some time, it is inevitable that sooner or later the position will arise when buyers will be able to discriminate. When they do, the good article will outsell its competitors. Many factories are doing excellent work. Seven factories had over 95 per cent. of all cheese graded classified as Choice or First Grade and several others over 90 per cent. These figures show what can be done, and other factories are urged to emulate the high standard which these have obtained. In this connection a word to suppliers would not be out of place. No factory can produce good cheese from inferior milk, and if suppliers could develop a sense of pride in their factory's product the factory's task would be easier.

Detailed statistics showing the production and gradings of individual factories are set out in tables at the end of this article. No details of cheese condemned or prohibited from export have been included, as much cheese which cannot be exported is suitable for local trade or for processing, while in some instances where a large consignment has been prohibited some of the lines included in the consignment may be quite suitable for export and may subsequently have been exported. Reference must be made, however, to the fact that several factories produced quantities of cheese which was prohibited from export because the fat content was below the standard prescribed. Factory managers are warned that a serious view will be taken of the production of cheese below standard in the future.

In reading the grading results for individual factories, care should be taken to observe the proportion of output which was graded. The figures cannot be accepted as a reliable guide to quality where the proportion was small.

SUMMARY OF CHEESE PRODUCTION AND GRADINGS FOR THE YEAR 1948-1949.

	Lb.		
* Milk received	204,092,535	Yield of cheese per 100 lb. milk	10·30
* Cheese made	21,018,093	Yield per pound of butterfat	2·7
* Butterfat paid for	7,791,841	Average butterfat test of milk	3·82

* Figures for the Queensland Farmers' Co-operative Association Ltd. factory for Booval have not been included in these calculations, as data for milk and butterfat are incomplete.

GRADINGS.

Total Submitted.	Choice.	First.	Second.	Third.
Lb.	Lb.	Lb.	Lb.	Lb.
13,485,996	38,109	9,600,970	3,722,762	124,155
	·28%	71·19%	27·61%	·92%

MANUFACTURE AND GRADINGS OF QUEENSLAND CHEESE FACTORIES FOR THE YEAR ENDED 30TH JUNE, 1949.

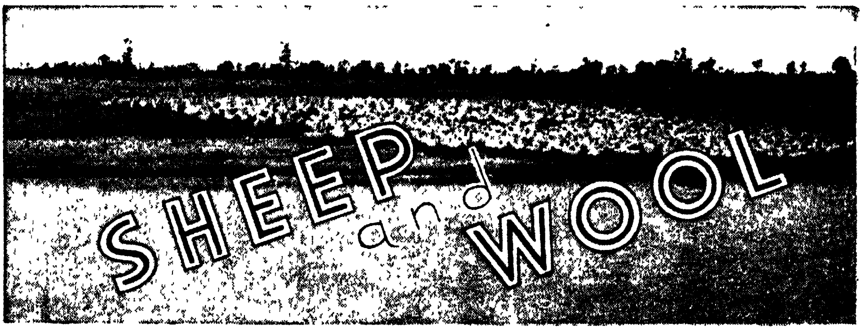
Factory.	Milk Received.	Production and Yield.					Official Gradings.				
		Cheese Green Weight.	Butterfat.	Cheese Yield.		Average Test.	Total Lb. Submitted and Per Cent of Manufacture	Choice.	First.	Second	Third.
				Per 100 Lb. Milk.	Per Lb. Butterfat.						
	Lb.	Lb.	Lb.	Lb.	Lb.	Per cent.					
Biddeston	6,899,803	739,403	259,368	10·72	2·85	3·76	399,185 55%	.. ..	347,417 87·03%	51,768 12·97%	.. ..
Coalstoun Lakes	1,657,341	168,957	62,441	10·19	2·71	3·77	26,721 15·8%	.. ..	. .	19,403 72·61%	7,318 27·39%
Daredale	2,335,507	224,096	88,142	9·6	2·54	3·77	217,328 97%	..	131,412 60·47%	83,508 38·42%	2,408 1·11%
Woodleigh	1,709,020	166,977	65,509	9·77	2·55	3·83	164,101 98·3%	..	111,743 68·09%	52,358 31·91%	.. ..
Boodua	2,787,734	296,662	118,078	10·64	2·51	4·24	334,283 100%	. ..	208,429 62·35%	123,090 36·82%	2,764 ·83%
Toowoomba	23,123,617	2,496,447	891,552	10·80	2·80	3·86	2,114,434 84·7%	.. .	808,525 38·24%	1,282,376 60·65%	23,533 1·11%
Dundarrah	1,186,997	116,021	44,798	9·77	2·59	3·77	28,587 24·6%	.. ..	1,932 6·76%	22,047 77·12%	4,608 16·12%
Felton	4,875,443	509,461	185,749	10·45	2·74	3·81	406,246 80·3%	.. ..	344,570 84·20%	64,676 15·8%	.. ..
Greenmount	3,238,666	343,459	122,151	10·6	2·81	3·77	131,200 38·2%	.. ..	.. ..	130,510 99·47%	690 ·53%
Highgrove	1,295,514	132,796	49,645	10·25	2·67	3·83	126,144 97·2%	.. ..	23,503 18·2%	100,762 78·02%	4,879 3·78%
Irongate	3,672,116	368,059	135,179	10·02	2·72	3·68	290,314 78·9%	16,909 5·82%	247,879 85·38%	25,526 8·80%	.. ..
Kooroongarra	4,225,570	427,523	154,836	10·12	2·76	3·66	409,826 95·9%	.. ..	337,198 82·28%	72,628 17·72%	.. ..
Kraft Walker Cheese Co. Pty. Ltd., Quinalow	9,529,910	980,410	359,432	10·29	2·73	3·77	176,690 18·0%	.. ..	40,374 22·85%	123,749 76·26%	1,567 ·89%
Malling	6,562,946	646,730	251,878	9·85	2·57	3·84	292,486 45·2%	.. ..	91,638 31·33%	191,138 65·35%	9,710 3·32%
Maclagan Valley, Maclagan	8,440,087	844,925	316,613	10·01	2·67	3·75	456,680 54%	.. ..	285,900 62·60%	158,288 34·66%	12,492 2·74%

Maclagan Valley, Kulpi ..	8,276,174	826,936	309,103	9·99		3·73	339,814 100%	.. ..	600,731 71·53%	235,649 28·06%	3,434 ·41%
Maryborough, Tansey	6,072,283	622,201	256,902	10·25		4·23	191,097 30·7%	810 ·42%	180,837 94·63%	9,450 4·95%	.. ..
Maxam, Cooranga North ..	7,109,935	753,701	293,434	10·6		4·13	637,655 84·6%	.. ..	575,289 90·22%	58,601 9·19%	3,765 ·59%
Maxam, Lilyvale	2,558,774	278,964	99,500	10·9		3·89	267,035 95·7%	.. ..	247,221 92·58%	19,814 7·42%	.. ..
Moola	4,598,670	456,792	169,150	9·93		3·68	353,181 77·3%	.. ..	324,300 91·82%	25,876 7·33%	3,005 ·85%
Mount Sibley	2,978,197	313,859	115,017	10·54		3·86	268,990 85·7%	.. ..	285,189 99·37%	1,801 ·63%	.. ..
Mount Tyson	5,867,963	607,067	219,252	10·35		3·74	29,653 48·8%	.. .	29,653 100%	.. ..	.. ..
Oakey, Kelvinhaugh	..	Ceased Production, 30–6–48					13,081 .	.	12,765 97·58%	316 2·42%	.. ..
Pittsworth, Pittsworth ..	5,344,237	557,566	217,105	10·43		4·06	251,851 45·2%	4,444 1·76%	214,230 85·06%	30,924 12·28%	2,253 ·90%
Pittsworth, Linthorpe	2,038,128	213,396	76,283	10·47		3·74	168,487 79%	.. ..	147,196 87·36%	20,644 12·25%	647 ·39%
Pittsworth, Scrubby Mt. ..	2,352,074	252,483	89,670	10·73		3·81	174,343 69·1%	.. ..	141,226 81·00%	32,959 18·91%	158 ·09%
Pittsworth, Springside	2,229,116	243,799	85,399	10·94		3·83	145,532 59·7%	5,879 4·04%	136,697 93·93%	2,956 2·03%	.. ..
Pittsworth, Yarranlea	5,592,851	579,651	212,102	10·36		3·79	334,861 57·8%	.. ..	264,142 78·88%	69,476 20·75%	1,243 ·37%
Port Curtis, Bracewell	3,853,017	395,839	141,186	10·27		3·66	398,433 100%	.. ..	362,000 90·86%	35,807 8·99%	626 ·15%
Port Curtis, Theodore	3,266,139	339,375	124,114	10·39		3·8	95,874 28·3%	.. ..	84,266 87·89%	11,608 12·11%	.. ..
Q.A.H.S. and College, Lawes ..	34,390	3,786	1,484	11·01		4·32	..	No Gradings	..	..	..
Queensland Farmers, Booval *	..	14,970	..	.		..	..	No Gradings	..	..	..
Ramsay	1,989,100	204,550	76,972	10·28		3·87	187,151 91·5%	.. ..	121,970 65·17%	65,181 34·83%	.. ..

* Data incomplete.

MANUFACTURE AND GRADINGS OF QUEENSLAND CHEESE FACTORIES FOR THE YEAR ENDED 30TH JUNE, 1949—*continued.*

Factory.	Milk Received.	Production and Yield.					Official Gradings.				
		Cheese Green Weight.	Butterfat.	Cheese Yield.		Average Test.	Total Lb. Submitted and Per Cent. of Manufacture.	Choice.	First.	Second.	Third.
				Per 100 Lb. Milk.	Per Lb. Butterfat.						
	Lb.	Lb.	Lb.	Lb.	Lb.	Per cent.					
Rockview	2,721,028	283,339	105,133	10·41	2 70	3·86	226,058 79·8%	. .	218,207 96 53%	7,851 3·47%	..
Rocky Creek	2,927,975	301,517	105,755	10·3	2·85	3 61	284,153 94 2%	..	173,476 61 05%	92,983 32·72%	17,694 6·23%
Rosemount	..	Ceased Production 30–6–48		..	..	.	6,384 ..	.. ..	6,384 100%	.. ..	.. ..
Southbrook	6,739,800	689,422	247,830	10 23	2·78	3 68	278,984 40 5%	490 ·16%	219,493 78·69%	58,760 21·06%	241 ·09%
South Burnett, Goomeri ..	5,088,118	518,282	201,982	10·19	2 57	3·97	430,353 83%	. .	342,677 79·63%	78,479 18·24%	9,197 2·13%
South Burnett, Murgon ..	4,980,979	474,892	194,322	9·53	2 44	3 9	312,340 65·8%	6,092 1 95%	301,710 96·6%	4,538 1·45%	. .
Sugarloaf	1,949,270	195,768	79,496	10 04	2·46	4 08	102,170 52 2%	..	51,663 50·57%	50,507 49·43%	. ..
Sunnyvale	1,672,673	184,053	66,998	11·00	2 75	4·01	49,064 26·7%	. .	30,407 61·97%	18,657 38·03%	.. ..
Warwick, Greymare	2,381,080	245,589	87,899	10·31	2 79	3 69	133,404 54 3%		64,148 48 09%	67,656 50·71%	1,600 1·20%
Warwick, Talgai	1,105,128	111,802	42,562	9·01	2·63	3 43	30,010 26·8%	.	5,605 18·68%	24,247 80·8%	158 ·52%
Warwick, Victoria Hill ..	657,360	67,633	23,958	11·31	2 79	4 05	21,149 31 3%	.	.. ..	10,984 51 94%	10,165 48·06%
Warwick, Mill Hill	21,731,470	2,177,413	804,630	10 02	2 71	3 70	1,211,095 55 6%	3,485 ·29%	1,151,207 95·06%	56,403 4·65%	. .
Yamsion	3,076,544	314,835	113,183	10 23	2 78	3·68	297,500 94·5%	.. ..	204,848 68·86%	92,652 31·14%	.. ..
Yargullen	3,359,791	341,657	126,049	10·17	2·71	3 75	148,069 43·3%	.. ..	122,913 83·01%	25,156 16·99%	.. ..
Totals	204,092,535	21,033,063	7,791,841	..	..	.	13,485,996	38,109	9,600,970	3,722,762	124,155



Lambing Losses.

G. R. MOULE, Officer-in-Charge, and M. N. S. JACKSON, Senior Adviser, Sheep and Wool Branch.

THE Australian Merino is often described as a breed of sheep which is not particularly fertile, and percentages of lambs marked to ewes mated are quoted to substantiate this statement.

Actually, the percentage of lambs marked is really a measure of the reproductive rate of the flock and it is influenced by the losses of lambs between birth and marking as well as the number of lambs which are born.

Recent investigations have focused attention on the serious proportions that losses between birth and marking may reach. In addition, it is well known that very often the ewe as well as the lamb is lost at lambing time and for this reason many properties write off 10 per cent. of their breeding ewes each year to cover what might be regarded as expected losses.

Losses of lambs are regarded as inevitable, but by careful management their incidence can be reduced considerably. The purpose of this paper is to acquaint sheep raisers with some of the factors influencing the survival of lambs and ewes at lambing time.

HOW SERIOUS ARE LAMBING LOSSES?

In a survey conducted recently the opinion of sheep men was sought about the extent and nature of losses of lambs between birth and marking. Most men considered their losses varied in the average year between 5 per cent. and 12 per cent. of the lambs born. One property owner was able to quote reliable figures to indicate that the losses of his stud lambs before marking had averaged about 12½ per cent. a year, but agreed that they were sometimes higher. Many men quoted disastrous results which had been obtained during drought years, or when lambing took place during extremely hot weather, or when dingoes attacked the lambing ewes. In one stud flock only eight lambs, from 200 known to have been born, survived to marking time, and on another occasion 600 lambs from a flock of about 800 perished on a water-hole during a heat wave. While such losses as these are spectacular and serious, the lesser but more constant losses which occur each year are probably more important. A trial conducted recently in north-western Queensland revealed that, even under favourable

conditions, 22 per cent. of the lambs could be lost within the first few days of birth. Needless to say, losses such as these can retard the rate at which flocks increase or can restrict culling percentages.

The causes of mortalities in very young lambs can be classified broadly as those affecting the ewe and the lamb and those which affect only the lamb, and they are described under their respective headings.

CAUSES OF MORTALITIES OF THE EWE AND/OR THE LAMB.

Ewes Unable to Lamb.

It is well known that ewes in Queensland may experience difficulty in lambing, but the factors predisposing them to trouble of this nature are not well understood. Being overfat can be an important contributing cause amongst crossbred ewes in the fat lamb areas, but on the other hand, extreme poverty may cause heavy mortalities amongst Merino ewes in the drier pastoral country.

Turning back of one or both front legs, or of the head, are the "bearing troubles" most commonly encountered, and while they are often difficult to detect and handle amongst flock sheep valuable stud animals can be saved by timely and carefully applied assistance. In cases such as these the lamb is most commonly strangled during birth

Pregnancy Toxaemia.

Pregnancy toxaemia is fairly common amongst breeding ewes in Queensland and it can be a serious cause of loss, as it is difficult to treat affected sheep. It usually occurs when ewes which are in advanced pregnancy are subjected to a period of starvation, such as occurs during a rail journey, or to rather sudden variations in their plane of nutrition.

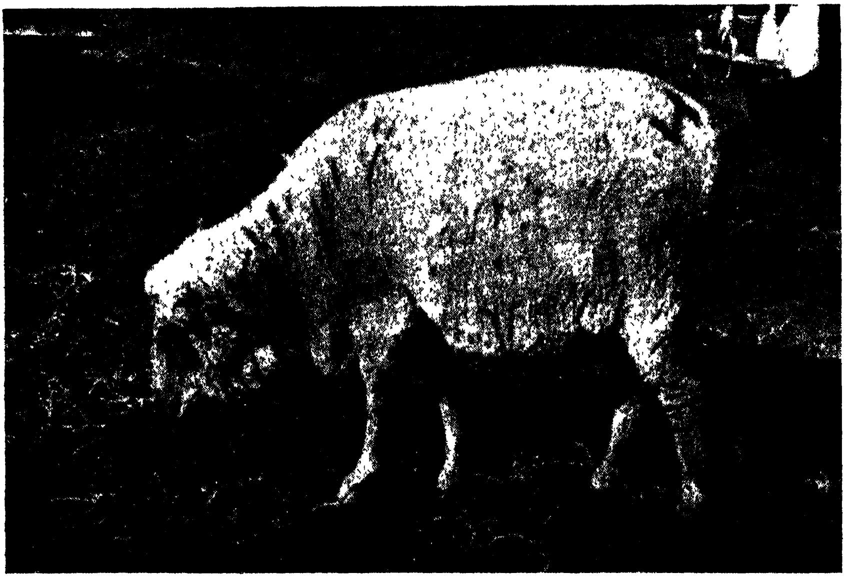


Plate 88.
EWE SHOWING TYPICAL SIGNS OF PREGNANCY TOXAEMIA.

Plate 89.
EWE DOWN WITH PREGNANCY TOXAEMIA.

Pregnancy toxaemia may reach "outbreak" proportions in a flock and it usually occurs amongst ewes which have not lambed. Affected sheep stand about in a listless fashion, appear to be blind, are disinclined to feed, but may grind their teeth. The course of the disease is protracted and sick ewes (Plates 88 and 89) may linger for seven or eight days before dying. Sometimes affected sheep abort, but the ewes seldom survive. Preventive measures obviously include the careful handling of pregnant ewes and, where necessary, supplementary feeding.

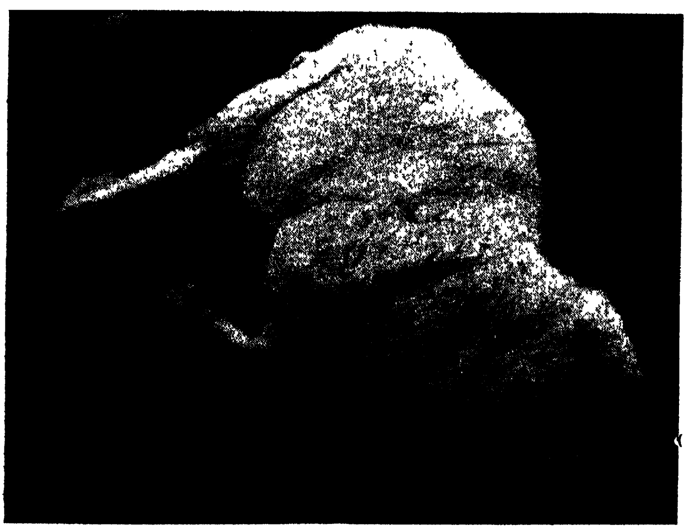


Plate 90.
EWE SUFFERING FROM MILK FEVER.

Milk Fever (Hypocalcaemia).

In some ways the history and symptoms of milk fever may resemble those of pregnancy toxaemia, but fortunately it is easy to treat animals suffering from this condition. It is caused by a sudden diminution in the amount of lime (calcium) circulating in the blood and affected animals respond quickly to injections of the drug calcium borogluconate. Milk fever may reach severe proportions when it occurs amongst ewes brought in for pre-lambing crutching or during some other procedure which necessitates their being held in the yards or being exercised. Sometimes cold, windy weather, infestation with internal parasites or the ingestion of certain poison plants may precipitate symptoms. In these circumstances the sheep are often "in hand" when the condition occurs and it can usually be recognised by the quickness of its course and the almost immediate recovery affected sheep will make if they are given subcutaneous injections of from 1½ to 2 ounces of 20 per cent. solution of calcium borogluconate. If the ewes are not treated they usually die and loss of the mother means loss of her lamb as well. Plate 90 shows a ewe down with milk fever.

Mastitis.

Mastitis is the name given to the inflammation of the udder. Although this disease is well known amongst dairy cows it is probably more common than is generally imagined amongst ewes. A few cases have been observed amongst ewes kept under close observation at lambing time and the disease has reached outbreak proportions on some properties. Mastitis may occur in a mild, uncomplicated form or it may be complicated and serious. In the former case the disease is not particularly important. There is a decrease in the amount of milk available for the lamb and the affected half of the udder may become permanently blind.

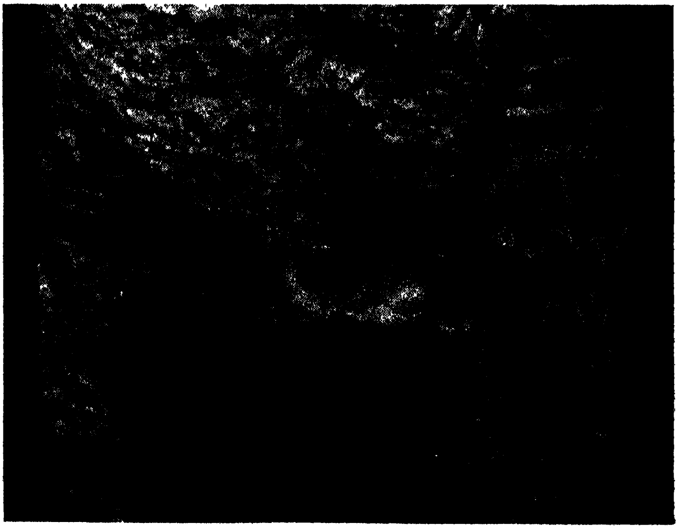


Plate 91.

THE TEATS AND UDDER OF A EWE SUFFERING FROM MASTITIS.
NOTE THE BLACKISH INFLAMED TEATS.

In its complicated form mastitis may lead to the death of the ewe. The udder becomes bluish-black in colour (Plate 91) and the affected ewe usually shows evidence of distress, lameness in her hind limbs, an increased respiratory rate and a high temperature. Prompt treatment, which consists of the administration of the drug sulphamezathine at the rate of 1 gram for every 15 lb. live-weight or the infusion of solutions of calcium penicillin into the udder, is necessary in most cases to save affected animals.

Accidents Associated With Lambing.

Most experienced sheep men are familiar with the accidents which may befall ewes at lambing time. They include an eversion of the breeding passage, or of the whole breeding bag, or rupture of the "skirt muscle" which separates the chest cavity from the belly. Although spectacular, the conditions do not usually account for a very large proportion of the ewes which die at lambing time. However, as most of these conditions are fatal the lamb is left as a "poddy" before he is old enough to survive.

Puerpural Sepsis.

Puerpural sepsis is the name given to the acute blood poisoning which sometimes occurs through virulent disease-producing bacteria gaining entrance to the breeding bag at lambing time. This condition is usually fatal within a few days and in most cases treatment is of little avail. Fortunately, it is not very common amongst ewes, but when it occurs it usually kills the ewe before her lamb is old enough to survive without its mother.

THE CAUSES OF ABORTION, OR LAMBS BEING BORN DEAD.

Vitamin A Deficiency.

The most important source of vitamin A to the sheep is green grass and during times of plenty the animal stores this vital substance in its liver. When the pastures become dry, as they do in the winter, the liver stores of vitamin A are used to meet the daily requirements. Vitamin A is essential to the normal utilisation of protein, which is so important for the growth and development of lambs, both before and after birth. Should the ewe receive insufficient vitamin A, small weak lambs may develop and on being born their chances of survival are slender. Alternatively, the ewes may abort before their lambs are fully formed.

Consideration of the conditions in Queensland reveals that a large number of ewes lamb at a time when the pastures are deficient in vitamin A, and although it has not been proved experimentally in this State, there is reason to believe that vitamin A deficiency might be a contributory cause to losses of baby lambs. Making sure the ewes have a vitamin A and protein-rich supplement during the latter stages of pregnancy (if the grass is dry) is helpful in reducing losses due to this cause.

Phenothiazine Drenching.

A few cases of abortion and/or of still-born lambs occurred amongst some flocks in New South Wales following the drenching of the ewes with phenothiazine within a fortnight or so of lambing. Because of this it is usually recommended that ewes should not be drenched with phenothiazine within a month or six weeks of lambing.

Abnormalities in Development.

"Freak" sheep are not commonly seen, because they usually die at, or within a few hours of, birth. However, it is doubtful if abnormalities in development are common enough in most flocks to reduce lamb-marking percentages appreciably.

Disease.

It is as well to remember that there are a number of diseases which may lead to lambs being aborted or born dead. As far as is known, none of these is prevalent in Queensland, but it is advisable to seek the assistance of Departmental officers in investigating such occurrences.

CAUSES OF EARLY DEATH OF LAMBS.

On most properties the greatest losses of lambs occur within three days of birth, and a large number of factors can cause quite heavy mortalities amongst new-born lambs. These are set out below.

Failure of the Lamb to get a Drink.

Some lambs seem to experience difficulty in finding the ewe's teat and for this reason it is advisable to lamb off shears or after crutching. However it should not be concluded that because a new-born lamb finds the teat that he has succeeded in getting a drink. A plug of detritus sometimes forms in the teat canal and it gets wedged so firmly that the lamb is unable to move it and although he suckles does not get any milk. The first milk is essential to a young animal because it contains substances which "move the bowels," and should the lamb not be able to get the first milk it soon becomes "tucked up" and constipated. Unless remedial measures are undertaken death is likely to supervene (Plate 92).

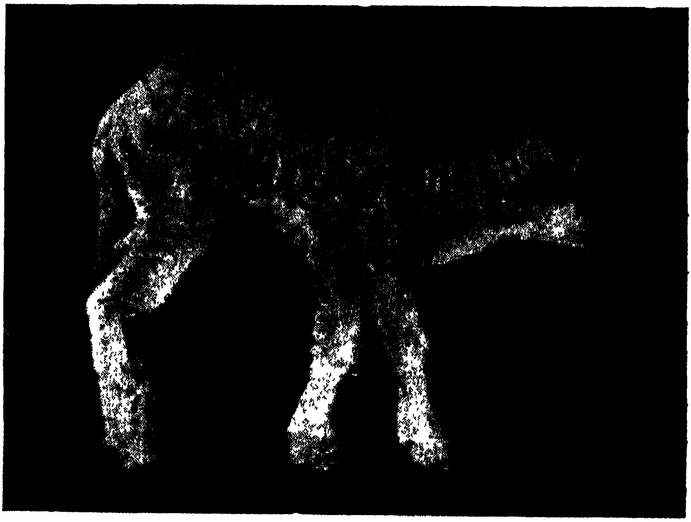


Plate 92.

LAMB, SIX HOURS OLD, WHICH HAS BEEN UNABLE TO GET A DRINK OF MILK OWING TO PLUGS IN ITS MOTHER'S TEATS.

It is difficult to ensure that the teats of flock ewes are "free," but when stud ewes are lambing under close supervision it is relatively easy to ensure that the teat orifice is open and that the lambs get a drink of milk soon after birth.

Extremes of Heat or Cold.

Extremes of heat or cold can cause heavy losses amongst newly born lambs. Cold, dry winds are especially trying at night because the baby lamb must generate enough heat to keep warm, as well as allow for the heat loss due to the evaporation of the moisture in his coat. This can be far too great a task for lambs born during the night and they may freeze to death unless they can find protection from wind.

Navel Infections.

Disease-producing organisms may gain entrance to the lamb's body through the navel, and when this occurs the lamb may become extremely ill. If death does not supervene quickly it is probable that the lamb will develop lameness in one or more limbs. It may not recover.

Copper Deficiency.

Copper is essential to sheep for the normal development of the nerves of the spinal cord, for the formation of red blood cells and for the growth of normal wool. When pregnant ewes do not receive adequate copper there may not be sufficient available to the lamb to ensure the normal development of the nerves of the spinal cord. When this occurs the new-born lambs quickly develop a swaying gait and they may finally become paralysed and die. Preventive measures consist of providing a copper supplement for breeding ewes depastured in areas where sheep are likely to suffer from copper deficiency.

Predators.

The predators most common in Queensland include foxes, crows, eagle hawks and pigs. The severity of attacks by birds and animals is well known to most wool growers, but it is as well to remember that the losses they cause are not the only ones which are likely to reduce lamb marking percentages.

FACTORS WHICH MAKE EWES FORSAKE THEIR LAMBS.

Ewes will sometimes forsake their new-born lambs. While it is commonly considered that maidens are likely to do this through inexperience, older ewes may leave their lambs because of ill-health or poverty, or through faulty management on the part of the owner.

Amongst the conditions of ill-health which are likely to cause ewes to forsake their lambs are pink eye, blowfly strike, crow peck, mastitis and foot rot. Of these there is probably little excuse for losses due to strike, as the following figures illustrate:—

FERTILITY OF EWES, STRUCK AND UNSTRUCK.

Ewes.	Percentage Wet.	Percentage Lambs.
Not Mules operated, struck	75	79
Mules operated, unstruck	92	100

EFFECT OF MULTIPLE STRIKES ON FERTILITY.

——	Number Strikes.	Percentage Ewes Wet.
Mules operated	0	92
Not Mules operated	1	88
Not Mules operated	2	73
Not Mules operated	3	58
Not Mules operated	4	47

Poverty.

It is well known that ewes lambing during a drought may walk away from their lambs immediately they are born. While such a procedure is not conducive to high lamb-marking figures, it probably ensures the greatest chance of survival for the ewes. Naturally, good management aims at lambing at a time which is favourable for the survival of the ewe and her offspring, but this is often difficult to achieve in areas where rainfall is unreliable.

Faulty Management.

Included under this heading are the factors which lead to unnecessary disturbance, such as too much handling, lambing in paddocks through which stock routes pass, and lambing in paddocks which are too large or too small. An important complication resulting from the last practice is that, contrary to popular belief, Merino ewes will adopt lambs to the exclusion of their own offspring (see Plate 93). On the other hand, should the paddocks be too large and inadequately watered young lambs may have difficulty in keeping up with their mothers when they go into water. This can result in heavy loss, especially in hot, dry weather.

THE RELATIVE IMPORTANCE OF THE VARIOUS CAUSES OF LOSS OF LAMBS.

Some of the causes which have been enumerated as being responsible for losses of baby lambs are capable of destroying the whole of a lambing. Such happenings are largely dependent upon seasonal conditions, and it is difficult to assign relative importance to them.

In a trial conducted in the north-west recently, in which ewes were lambed under ideal nutritional conditions and within netting enclosures to exclude foxes and pigs, 22 per cent. of all the lambs born could have been lost had remedial measures not been undertaken. These were successful in reducing the losses to about 12 per cent. A dissection of the causes of potential losses is shown in the following table:—

Cause of Loss.	Percentage of all the Lambs which Died.
Lambs unable to drink because of plugged teats	30
Lambs which were weak at birth and/or premature	23·3
Extremes of cold	16·6
Forsaken by mother or mother died	13·6
Crow pick	6·6
Strangled at birth through bearing troubles	6·6
Unknown	3·3

In another trial conducted by a grazier in the Longreach area, 34.5 per cent. of the lambs born did not survive until lamb marking. Fifty-six per cent. of these losses were probably due to predators. Apart from predators the greatest variation is likely to occur in the number of lambs which are forsaken at birth or whose mothers die at lambing, in the number which die as the result of extremes of heat or cold and in the number which are weak at birth or which are premature. Fortunately, these are the conditions which are most likely to be offset by correct and careful management.

Plate 93

A CASE OF ADOPTION.—The ewe on the right is seen "adopting" the new-born lamb of the ewe on the left, to the exclusion of her own lamb, which is following the "displaced mother," who refused to adopt it as her own.

TUBERCULOSIS-FREE CATTLE HERDS (AS AT 1st SEPTEMBER, 1949).

Breed.	Owner's Name and Address of Stud.
Aberdeen Angus ..	The Scottish Australian Company Ltd., Texas Station, Texas.

ASTRONOMICAL DATA FOR QUEENSLAND.

NOVEMBER.

Supplied by W. J. Newell, Hon. Secretary of the Astronomical Society of Queensland.

TIMES OF SUNRISE AND SUNSET.

At Brisbane.			MINUTES LATER THAN BRISBANE AT OTHER PLACES.					
Day.	Rise.	Set.	Place.	Rise.	Set.	Place.	Rise.	Set.
	a.m.	p.m.						
1	4.59	6.05	Cairns	45	12	Longreach	42	28
6	4.55	6.09	Charleville ..	29	25	Quilpie	33	37
11	4.52	6.12	Cloncurry	61	38	Rockhampton ..	17	3
16	4.50	6.16	Cunnamulla ..	28	31	Roma	18	15
21	4.48	6.20	Dirranbandi ..	17	21	Townsville ..	37	12
26	4.47	6.24	Emerald	26	13	Winton	49	31
30	4.46	6.27	Hughenden ..	46	24	Warwick	3	6

TIMES OF MOONRISE AND MOONSET.

At Brisbane.

Day.	Rise.	Set.
	p.m.	a.m.
1	2.10	2.27
2	3.02	2.54
3	3.53	3.21
4	4.46	3.47
5	5.39	4.16
6	6.34	4.46
7	7·31	5.20
8	8.29	6.00
9	9.26	6.45
10	10.21	7.37
11	11.11	8.34
12	11.56	9.34
13	..	10.37
	a.m.	
14	12.36	11 41
		p.m.
15	1.13	12.45
16	1.48	1.49
17	2.21	2.54
18	2.56	4.01
19	3.33	5.11
20	4.15	6.23
21	5.04	7.36
22	5·59	8.43
23	7.01	9.44
24	8.05	10.36
25	9.09	11.19
26	10·11	11.56
27	11.08	..
	p.m.	a.m.
28	12.04	12.28
29	12.56	12.56
30	1.48	1.23

MINUTES LATER THAN BRISBANE (SOUTHERN DISTRICTS).

Charleville 27; Cunnamulla 29; Dirranbandi 19; Quilpie 35; Roma 17; Warwick 4.

MINUTES LATER THAN BRISBANE (CENTRAL DISTRICTS).

Day.	Emerald.		Longreach.		Rockhampton.		Winton.	
	Rise.	Set.	Rise.	Set.	Rise.	Set.	Rise.	Set.
1	22	15	38	31	13	6	43	35
6	12	26	27	42	2	17	30	49
11	9	30	25	45	0	21	26	54
16	16	20	32	36	8	11	36	42
21	29	9	44	24	19	0	52	26
26	27	13	43	28	18	3	50	30
30	19	19	34	35	10	10	39	39

MINUTES LATER THAN BRISBANE (NORTHERN DISTRICTS).

Day.	Cairns.		Cloncurry.		Hughenden.		Townsville.	
	Rise.	Set.	Rise.	Set.	Rise.	Set.	Rise.	Set.
1	35	20	54	44	39	29	29	18
3	26	30	47	50	32	35	22	25
5	16	39	41	57	26	42	14	34
7	7	49	36	63	20	49	7	41
9	2	56	33	67	17	53	3	46
11	3	56	34	67	18	53	4	46
13	12	49	38	63	23	49	11	41
15	18	38	42	56	27	41	16	33
17	29	25	50	47	35	32	25	22
19	42	12	58	38	43	24	35	12
21	52	3	66	32	50	18	43	4
23	56	2	68	32	52	17	46	3
25	52	8	66	36	50	21	43	8
27	43	13	59	39	44	24	36	13
29	32	24	52	46	36	31	26	21
30	27	28	49	49	33	34	23	24

Phases of the Moon.—Full Moon, November 6th, 7.09 a.m.; Last Quarter, November 14th, 1.47 a.m , New Moon, November 20th, 5.29 p.m., First Quarter, November 27th, 8 01 p.m.

On November 15th the Sun will rise and set 20 degrees south of true east and true west respectively, and on November 2nd and 17th the Moon will rise and set approximately at true east and true west, respectively.

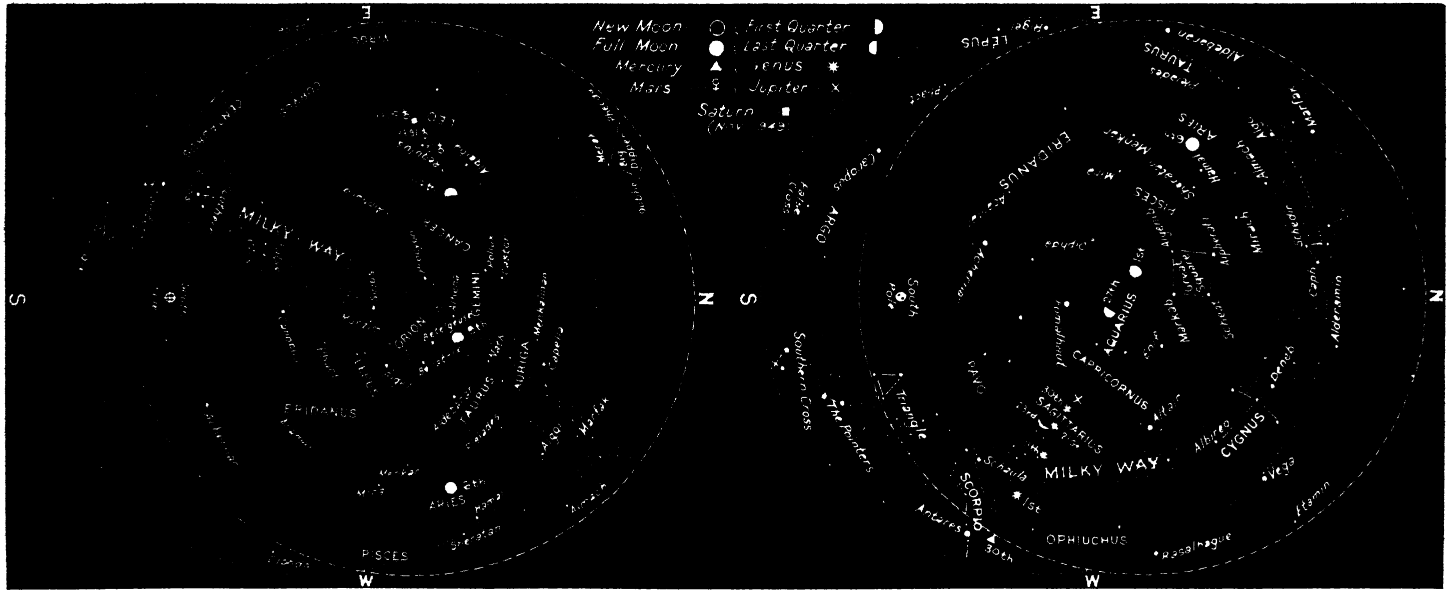
Mercury—At the beginning of the month, in the constellation of Libra, will rise 35 minutes before the Sun. On the 21st it will be in line with the Sun, after which it will pass into the evening sky and by the end of the month will set 25 minutes after the Sun.

Venus.—Now a most brilliant object in the western evening sky, where on the 1st it will set 3¾ hours after the Sun and on the 20th will reach greatest angle from the Sun. By the end of the month it will set 3½ hours after sunset.

Mars.—In the constellation of Leo, at the beginning of the month will rise between 1.45 a.m. and 3 a.m. and on the 30th will pass less than one degree north of Saturn.

Jupiter.—At the beginning of November will set about midnight and at the end of the month will set between 10 p.m. and 11.15 p m.

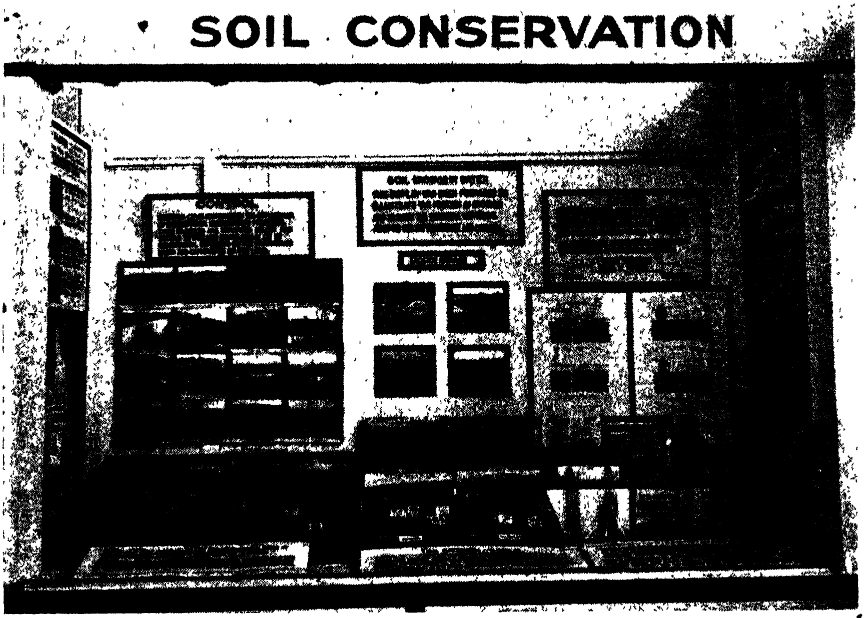
Saturn.—Will rise between 2.15 a.m. and 3.30 a.m. at the beginning of the month and about midnight at the end of the month.



Star Charts.—The chart on the right is for 7.15 p.m. in the south-eastern corner of Queensland to 8.15 p.m. along the Northern Territory border on the 15th November. (For every degree of Longitude we go west the time increases by 4 minutes.) The chart on the left is for 7 hours later. On each chart the dashed circle represents the horizon as viewed from Cape York and the dotted circle is the horizon for places along the New South Wales border. When facing north, hold "N" at the bottom; when facing South hold "S" at the bottom, and similarly for the other directions. Only the brightest stars are included and the more conspicuous constellations named. The stars, which do not change their relation to one another, moving east to west, arrive at any selected position about 4 minutes earlier each night. Thus, at the beginning of the month the stars will be in the positions shown about 1 hour later than the time stated for the 15th, and at the end of the month about 1 hour earlier than that time. The positions of the moon and planets, which are continually changing in relation to the stars, are shown for certain marked days. When no date is marked the position is for the middle of the month.

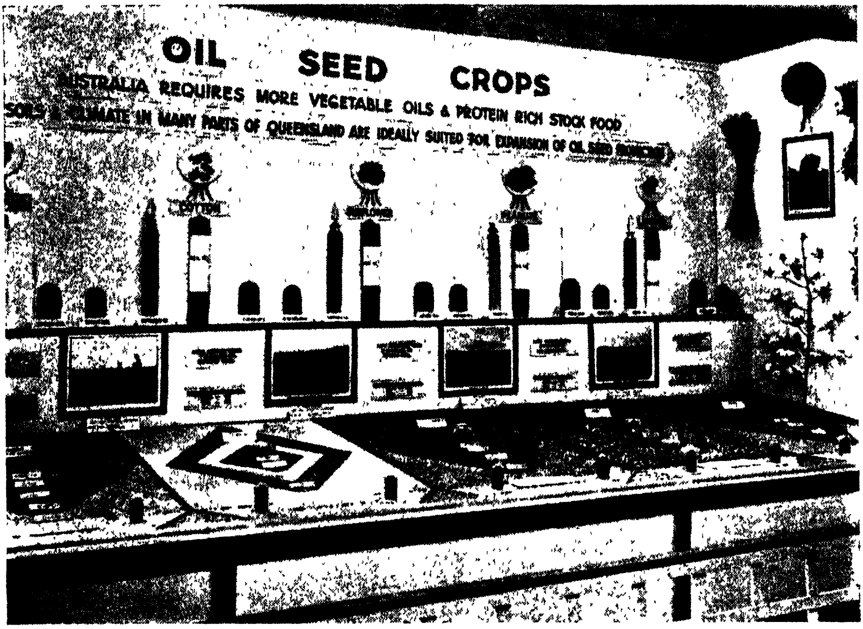
The Royal National Show.

VIEWS OF THE DEPARTMENT'S COURT.

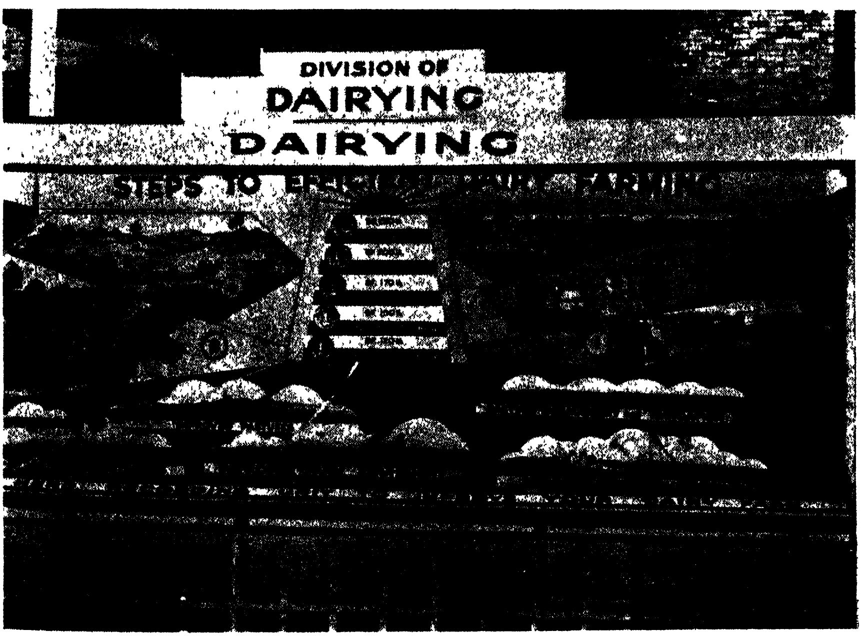


Soil Conservation.—The ravages of soil erosion and methods for its prevention and control were strikingly illustrated by photograph, diagram and model.

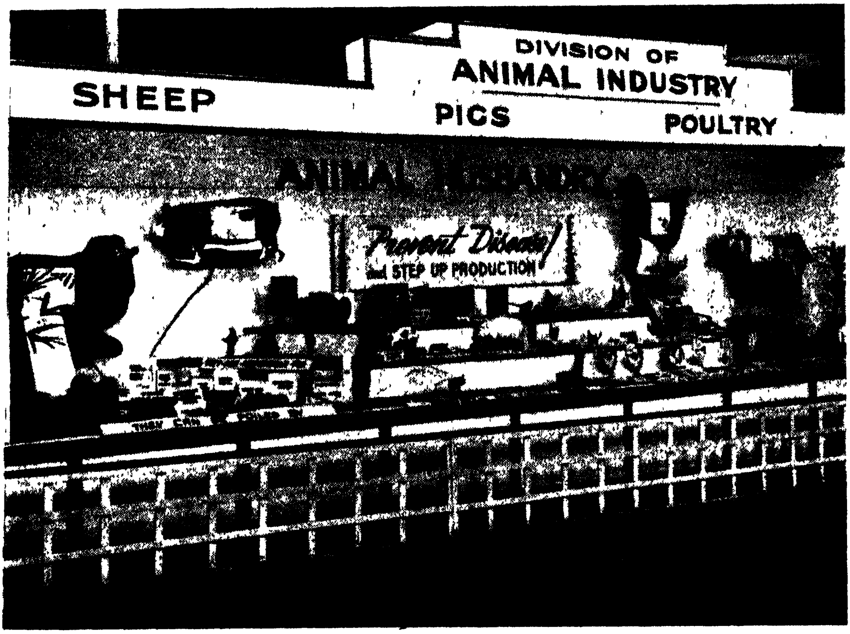
Marketing and Standards.—The crop reporting system of the Division of Marketing was explained in an attractive manner. The Standards Branch of the Division brought home to the farmer the requirements of liming materials.



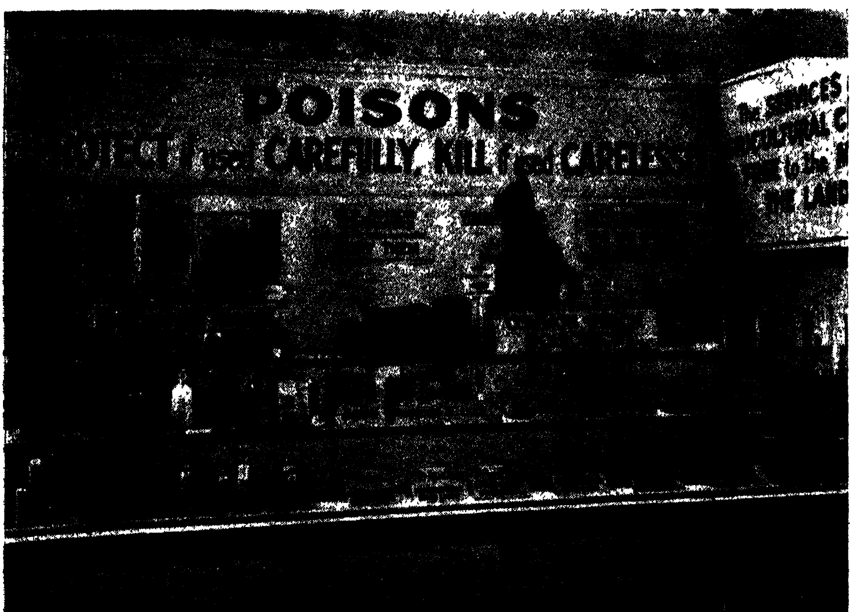
OIL SEED CROPS.—The Agriculture Branch in a neat and informative display set out the main features of oil seed crops, the production of which could bo expanded in Queensland.



HERD RECORDING.—In colourful fashion, the Division of Dairying set out the part which herd recording can play in increasing efficiency on the dairy farm.



Disease Prevention.—The theme of the Division of the Animal Industry's section of the Court was the prevention of disease in livestock. A commentary on the exhibit was given by wire recorder at intervans.



Agricultural Chemistry.—The Chemical Laboratory featured the dangers of stock poisoning from the careless use of poisons on the farm, and also showed how fertilizers and other farm requirements are analysed.

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9

Contents

Sorghum Growing in Queensland.

L. G. MILES, Senior Plant Breeder, Agriculture Branch.

(*Continued from page* 213 *of October issue.*)

SWEET SORGHUMS.

General and Historical.

IT is essential to realise that there is no hard and fast difference between the grain sorghum and the sweet sorghum types. Both arose from the same original sources, and their representatives will inter-cross freely, with no evidence of sterility. Recognised grain sorghums may have sweet juicy stalks and leaves, and conversely many of the well-known sweet sorghums are capable of producing high yields of grain. It is purely an arbitrary classification, therefore, which distinguishes the sweet or fodder sorghums from the grain sorghums by their greater height, more juicy stalks and leaves, and the higher sugar content of the juice. The main considerations for a good fodder crop are a high bulk per acre, and high quality and palatability of that bulk. These requirements are best satisfied within the sorghum group by the tall, vigorous, leafy varieties which are commonly known as sweet or saccharine sorghums.

Most of the sweet sorghums commonly cultivated today are derived directly or indirectly from a collection made in Natal during the middle of the nineteenth century by an Englishman named Leonard Wray. The varieties in this collection were planted out in Europe, without great success, and in 1857 they were taken to America for trial in the southern United States. Here they met with rapid success, providing both fodder for farm animals and syrup or "sweetening" for use in the farm kitchen in place of cane sugar. Many of these original strains have proved so suitable for the purposes for which they were required that there has been relatively little breeding work carried out in the improvement of this crop. One minor objection to the majority of these varieties (the brown-seeded types) is that the seed is somewhat bitter and unpalatable owing to its tannin content. Though this objection has not been regarded very seriously in most sorghum-growing countries, some steps have been

taken by hybridisation to alter the grain colour to white (as in Atlas) and thus eliminate the tannin content. A more important shortcoming in some varieties (for example, Jones, Sumac and Dwarf Ashburn) is the ease with which their stems lodge or tangle under certain conditions. Some attention has therefore been devoted also to the selection of varieties with strong stalks, such as White African and Atlas, the use of which greatly simplifies the problems of harvesting.

Sweet sorghums have been introduced into Australia, largely from the United States, at many times in the past, and are now a long

Plate 94.

A Sweet Sorghum Crop Suitable for Silage.

established standard crop on Queensland dairy farms. Such crops are grown principally for green feed, and to a lesser extent for ensilage or for direct grazing by stock.

Analyses have shown that the nutritive ratio of the sweet sorghums is wider than that of green maize—that is, there is a lower ratio of digestible protein to carbohydrates and fats in the former than in the latter. Green sorghum, therefore, though much relished by all kinds of stock, is not as well balanced a diet as is green maize, and should be fed in conjunction with a protein concentrate or a protein-rich hay if best value is to be obtained from its use. Another disadvantage of sweet sorghum in comparison with maize as fodder is the risk of poisoning with the former if used prior to the heading stage; maize can be fed with safety at any stage of growth. Sweet sorghums, however, have the important advantage that, while under favourable conditions of rainfall and soil they can produce crops at least as heavy as maize, under less favourable conditions they may be far more productive than maize. They also preserve their succulence for a longer period than does maize after the onset of winter.

Planting and Cultivation.

Preparation of the soil follows the same course as for grain sorghums, since the same requirements must be met in providing for a good strike of plants and good early growth and development. A fine moist seed-bed may at times be even more important with this crop than with grain sorghums, because of (1) the generally smaller seed size, and (2) the manner in which the seed of certain varieties is tightly held within the hulls.

Sowing is carried out by means of the maize planter, by the combine drill, or by broadcasting. The method of planting and the distance apart of the rows will depend largely upon the intended use of the crop and the harvesting procedure to be adopted. Where the crop is to be hand-cut or harvested with the maize-binder, planting in rows 3 ft. or 3 ft. 6 in. apart at a rate of 3 to 5 lb. of seed per acre is recommended. This can be accomplished by means of either the maize planter (with sorghum plates) or the seed drill with the appropriate runs blocked. Planting at these row spacings makes for tall stout stalks which are better able to resist wind damage than the finer stalks produced by heavier seeding. Row-planted crops will require inter-row cultivation for the control of weeds and maintenance of a surface mulch. Such cultivation will normally cease when the plants have attained a height of about 4 ft. and have begun to provide an effective cover of the inter-row spaces.

Where the crop is required for grazing or for mowing, it is essential that the stems be finer and softer than those produced under the above conditions. This is accomplished by broadcasting the seed or by drilling it in at a 7-inch or 14-inch row spacing; average seeding rates would be 12 to 15 lb. per acre for broadcasting or 7-inch row spacing, and 7 or 8 lb. per acre for 14-inch row spacing. Broadcasting is normally followed by a light harrowing to cover the seed, and sometimes rolling also is required to ensure that the seed makes contact with good moisture. Drilling, of course, is usually a far more efficient means of seeding the crop than is broadcasting. No further cultivation is usually given to close-planted crops except perhaps a harrowing when the crop is well rooted and about 6 inches in height.

Harvesting and Utilisation of the Crop.

Efficient utilisation of a bulky crop such as sweet sorghum demands that it be cut and chopped up before going to the feed-box or silo. When there is no power equipment available for harvesting, the crop must be cut with a cane-knife and passed through a chaff-cutter to prepare it for box or trough feeding. When used for green feed the crop is normally harvested in daily sections, and the day's cut transported from the field on a slide or wagon. Where stall-feeding is not practised, the stalks may be thrown whole into the night paddock of dairy cows or into pig pens. Feeding by this means is more wasteful than feeding chopped material, but the wastage in feed may be compensated for by the saving in time due to elimination of further handling.

The ideal period at which to cut sweet sorg' ums for green feed is when the grain is at the milky stage. By this time maximum growth has practically been attained, and the plants are more succulent and less fibrous than at later periods. However, if the crop is fed over a considerable period by means of daily cutting, it is profitable to commence cutting at an earlier stage so that the average stage at

harvesting will approximate to that suggested. Staggered plantings, or the use of both early and late maturing varieties at the one planting period, may enable a crop to be utilised over a period of two or more months.

Many dairymen have ample grazing for their stock during the late summer and autumn, and therefore do not require sorghum fodder at the time at which this crop would normally be approaching maturity. They prefer, therefore, to let their crops stand over into the winter to provide fodder when pastures have almost ceased production. This standing over of sweet sorghums involves a definite loss both in food value and in palatability, particularly after frosts have occurred. Leaf may be killed by frosting or spoiled by the bacterial red-spot or red-streak diseases which are commonly but incorrectly referred to as "rust." Drying out of the stems gradually takes place, and changes occur in the sap, often resulting in fermentation and souring. Certain varieties have, however, definitely shown their ability to hold their sweetness and palatability well into the winter. The growing of such varieties for late harvesting may therefore have much to justify it in spite of the losses which inevitably occur upon standing.

When sweet sorghum is planted for the provision of a silage crop, it should normally be planted at mid-season so as to enhance its prospects of producing the maximum bulk of leafy and juicy material. It is preferably harvested when the grain has reached the dough stage, as by this time the maximum green weight has normally been attained. Crops for silage are sometimes cut by hand and carted in for chopping prior to charging the silo; this method is, however, slow, and expensive of human labour. Harvesting is greatly accelerated if a maize-binder is used in place of the cane-knife, but considerable labour is still required to transport the material to the silos. It would appear that the ideal method of ensiling sorghum material to-day is by means

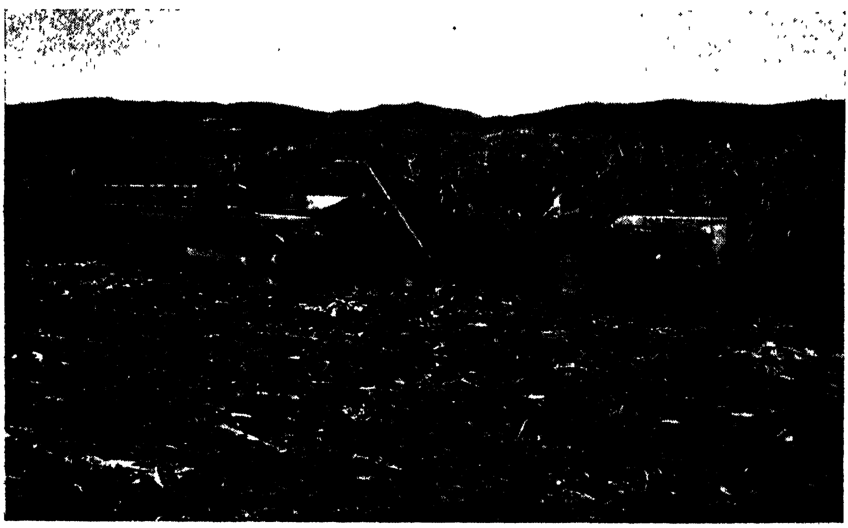


Plate 95.

ENSILAGE HARVESTER HANDLING A CROP OF MAIZE AND DELIVERING THE CHAFFED MATERIAL INTO A MOVING TRUCK.—Sweet sorghums are harvested in identical manner by such machines.

Plate 96.
CHOPPED ENSILAGE BROUGHT BY TRUCK DIRECT FROM THE FIELD BEING FED INTO A BLOWER FOR THE FILLING OF TOWER SILOS.

of the new combine ensilage harvesters. These machines continuously cut and chop the standing crop, blowing the chaffed material into a trailer which accompanies the machine round the field (Plate 95). When one trailer is filled, it is immediately driven off to the silo (Plate 96), and an empty trailer takes its place alongside the machine. By the use of such machines, manpower is reduced to a minimum in the handling process.

One other method of use of sweet sorghums is by direct grazing. This is not often practised in Queensland, as Sudan grass is generally regarded as a more suitable crop for the purpose. It is also much commoner to see grain sorghums grazed than sweet sorghums, as the former, though grown primarily as grain crops, are almost always planted with the dual purpose usage in view. When sweet sorghums are fed off during early growth, much useful grazing may result, but precautions must be taken to avoid the risk of sorghum poisoning. Where stock are given direct access to a crop which has passed the heading stage, much wastage normally occurs. Such wastage may, however, be reduced to a minimum if the crop is subdivided into small areas which are individually heavily grazed in turn.

Many of the taller, late-maturing varieties of sweet sorghum are capable of yields of more than 20 tons of green material per acre. Yields of 15 to 20 tons per acre have frequently been recorded with 3 ft. 6 in. row spacings, even in drier districts such as the Callide Valley. On poorer soils, or in seasons of insufficient rainfall, yields of 10 to 15 tons per acre will be closer to expectation.

Harvesting for Seed.

The bulk harvesting of sweet sorghums for seed is often a difficult process on account of the height attained by these plants. Crops which are required for seed may be allowed to mature their grain in the field, or in the stook if hand-cut or harvested by the maize binder. Grain from such stalks or sheaves can be readily threshed in stationary threshers, and the residue set by for stock food. Since stationary threshers of the required type are rare in Queensland, however, it is to the header-harvester that most farmers look for the harvesting and threshing of their seed. Seed of many varieties has been satisfactorily handled by this means, particularly in the drier districts, where plant heights may not exceed six or seven feet. One or two rollers are used above the comb to push the stalks forward and bring the heads down to a more suitable level for cutting. Even so, the process is often slow, and stoppages may be frequent. Some farmers have provided their own adaptations to standard headers for grain harvesting from tall crops. One such modification which has proved successful is the replacement of the existing comb with a high comb which cuts the heads at an appropriate level and passes them down a shoot to the elevator in front of the threshing drum. It would appear that farmers specialising in the production of sweet sorghum seed would require either some such modification to an existing machine or a specially designed header with a comb which is capable of being racked up to six feet or more.

Varieties.

Sweet sorghum varieties have been in a state of considerable confusion for many years, due partly to the inter-varietal hybridisation which has frequently occurred and partly to the loose use of varietal names. Some of the older varietal names, such as Imphee, or more recently Saccaline, have come to be identified by farmers with sweet sorghums in general, just as Milo has frequently been loosely used as a general term for grain sorghums. The only remedy for this confused state of affairs is for farmers and seedsmen to take some trouble in learning to recognise the better varieties, and to insist on the maintenance of high standards of purity within them.

Among the earlier introductions during the last century were a range of types which have been widely spread throughout our farming districts and are well known under such names as Imphee, Planter's Friend, Saccharatum, Early Amber and Black Amber. In Queensland, most of these varieties have given way to Saccaline, and those that remain are often badly contaminated and loosely named. In recent work, Saccaline has been adopted as the standard or check variety against which anything new must be tested. The detailed descriptions following deal therefore with Saccaline and with a number of other varieties of equal or greater merit, of which pure seed stocks are being maintained within the State.

Saccaline (Plate 97).

Saccaline is a tall, late-maturing variety which has proved itself capable of heavy fodder yields under a wide range of conditions in Queensland. Over a number of years its height has varied from 8 feet to 11 feet, though considerable reduction in height (coupled with failure to head) may result from conditions of drought or very low soil fertility. Heading occurs within 2 to 3 months, and grain ripens on the primary stalks in 3 to 4 months. Foliage is abundant, but fires

Plate 97.

HEADS OF SWEET SORGHUM VARIETIES.—Saccaline on left; Sugardrip on right.

rather early under dry conditions, and the crop presents a somewhat stemmy appearance compared with Sugardrip or White African; stems and leaves are juicy and sweet. Saccaline tillers very freely, producing up to five or six stalks per plant. Stem-branching may be

absent in some seasons, but fairly marked at other times. Heads are irregularly cylindrical, though they may become small and oval under droughty conditions; properly developed heads are normally fairly open in texture, with the lower branches tending to spread a little. Awns are absent. Glumes are small and black, usually with few hairs remaining at maturity. The grain is small, but projects quite prominently from the glumes; it is distinctly elliptical in shape (as contrasted with the more rounded shape of the grain sorghums), and is a rather dark reddish brown in colour (normally lighter than Sumac, but darker than Sugardrip). Saccaline is capable of green yields of 20 to 30 tons per acre, and is widely adapted in Queensland. It suffers by comparison with some of the following varieties in its greater tendency to lodge (particularly following strong winds), and in its greater susceptibility to the bacterial red spot which may badly disfigure the leaves and stems.

Sugardrip (Plate 97).

Sugardrip is another vigorous, brown-seeded, late maturing variety which superficially bears a very close resemblance to Saccaline. Its height ranges from 8 feet to over 10 feet, except in stunted crops. Full heading stage occurs in from $2\frac{1}{2}$ to 3 months, and the primary tillers mature their grain in $3\frac{1}{2}$ to 4 months; grown alongside Saccaline in Central Queensland over a period of years, it has averaged approximately a week later in its maturity. Its foliage is good to very good, being usually more abundant than that of Saccaline, and both stems and leaves are juicy and very sweet. Sugardrip tillers freely, like Saccaline, but has proved much less inclined to develop stem-branches. Heads are approximately 10 inches by $2\frac{1}{2}$ inches, irregularly cylindrical in shape, and of medium density. Awns are absent, and the glumes are black and almost hairless. The grain is small, brown, and well exserted from the glumes; in shape it is rounded on top and pointed at the base, rather than elliptical as in Saccaline. The grain can normally be distinguished from that of Saccaline by this slight difference in shape and the generally lighter shade of colour. This variety has made an excellent impression in Queensland, being capable of yields equal to those of Saccaline and often providing more attractive fodder. The variety stands well under all but excessively windy conditions, and is less prone to red spot than Saccaline, Sumac, Honey and a number of other varieties. It is capable of retaining its sweetness following frosting, and has on one occasion in the Lockyer Valley provided sweet juicy stalks in August, eight months after planting. It is recommended for use for either fodder or ensilage throughout the agricultural districts of Queensland.

White African.

This is a variety which is by no means new to Australian agriculture, but which has never been widely grown in Queensland in spite of its undoubted yielding ability. It is tall, ranging from 8 feet to 11 feet under medium to good conditions of growth, and has the same growing period as Sugardrip. Its foliage is normally quite abundant, but the leaves are widely spaced on the stems. The juice is quite sweet, as in other varieties of sweet sorghum, but this juice is not as abundant as in some varieties, particularly as maturity is approached. The variety stools moderately freely; but tends to have fewer and stouter stalks than the preceding varieties. Heads of this variety

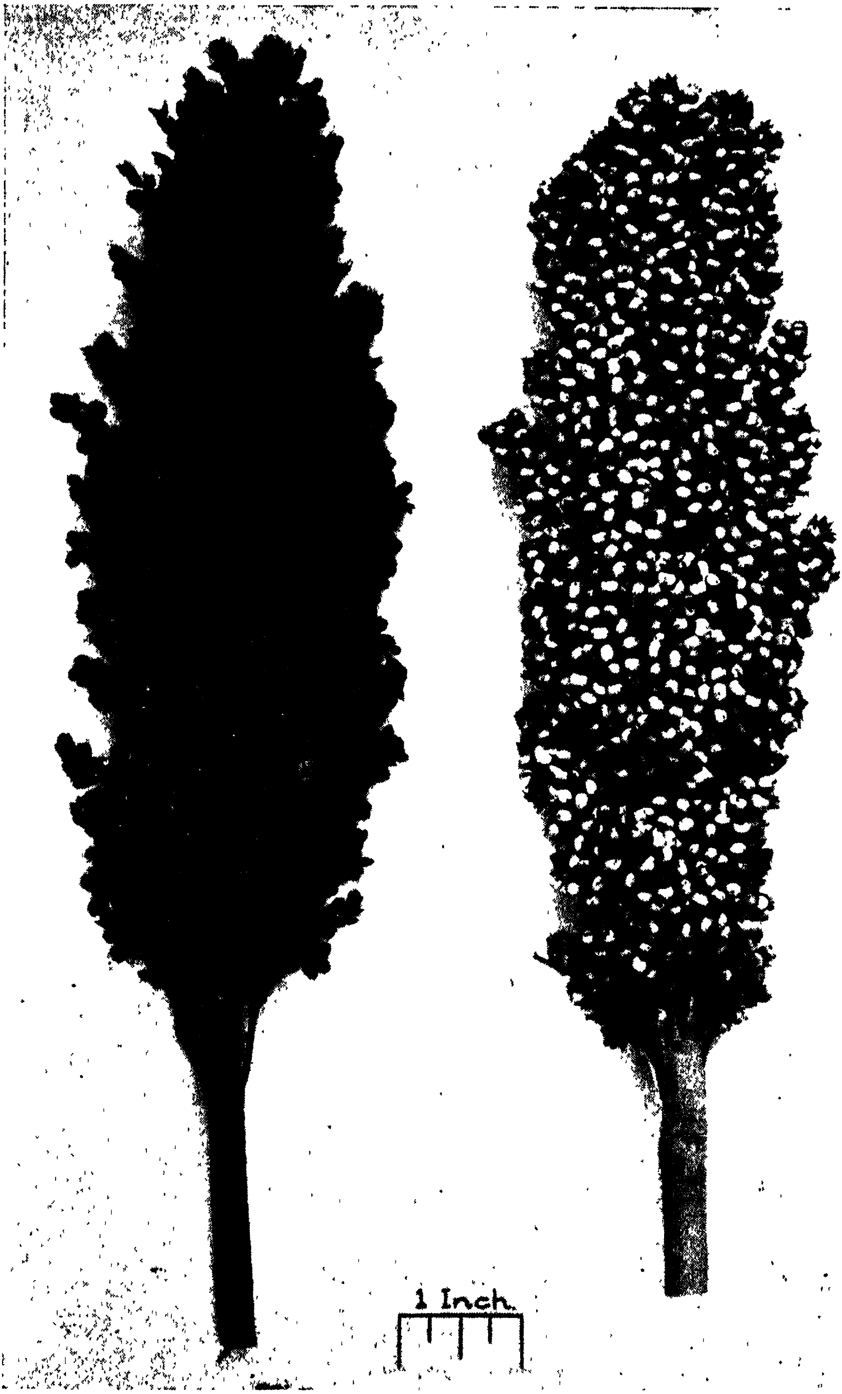


Plate 98.

HEADS OF SWEET SORGHUM VARIETIES.—Italian on left; Atlas on right.

are oval rather than cylindrical and are more open and spreading than in any of the other varieties, except Honey. Awns are absent, and the black glumes hold the grain tightly, covering it almost to the tip. The grain is medium-small, distinctly elongated (elliptical) in shape and a clear enamel white in colour. Its head shape and grain colour distinguish this variety clearly from other known varieties of sweet sorghum. The variety is very sturdy and erect, being able to resist lodging under very windy conditions; this is an important factor, particularly where mechanical harvesting is practised. White African is also fairly resistant to red spot, its leaves and stems being frequently without blemish when Saccaline is quite severely blotched. It carries quite well into the winter, but is less juicy throughout than most of the other varieties. This should be a useful silage variety, particularly for mechanical harvesting, but should be handled before it becomes over-mature.

Atlas (Plate 98).

Atlas is another white-seeded sweet sorghum, which is readily distinguishable from White African, however, on the basis of its seed-head characters. Its height normally ranges from 7 feet to 10 feet, being up to a foot shorter than Saccaline under comparable conditions. It heads in from 2 to 3 months and matures in 3½ to 4 months. Stems are stout, strong and erect, and yet of very satisfactory sugar content; foliage is present in good proportion to the stems, and both stems and leaves are very free from red spot. Tillering is quite free, providing well stooled plants, and stem-branching ranges from nil to very heavy. Heads are very similar to those of Blackhull Kafir, and not unlike those of the well known grain variety Hegari. Their size is approximately 9 inches by 2½ inches, and they are typically of medium density or somewhat denser. Awns are completely absent. Glumes are black and somewhat hairy, and allow of considerable exposure of the grains. The latter are medium-small to medium in size, rounded to slightly elliptical in shape, and creamy white in colour with occasional reddish brown spots or blotches. This variety, like White African, has proved very sturdy and free from lodging, but under Queensland conditions appears to be juicier and very palatable to stock. In yield tests it has not proved quite so productive as Sugardrip, White African and Saccaline, but is capable of producing quite a useful re-growth after the initial cutting. Like Sugardrip and Italian, it has shown its ability to hold over well into the winter without serious fermentation or loss of sweetness. It has also shown itself widely adapted to Queensland conditions, and should be ideal for mechanical harvesting.

Italian (Plate 98).

Italian is another brown-seeded sorghum of the Saccaline-Sumac group but appreciably earlier in its maturity than any which have been previously described. Under average conditions its height is from 6 feet to 9 feet. It requires 8 to 11 weeks to come into full head, and may mature its early grain in under 3 months, but more usually about 3½ months are required. Foliage is ample under good conditions, though inclined to be sparse in a short, dry season. The variety tillers moderately well, and branches very freely under the stimulus of late rains. Primary heads may be medium-large (approximately 9 inches by 2½ inches), elliptical in shape and usually slightly open in texture; the secondary heads arising from stem-branches are usually much smaller, slenderer, and more tight. Awns are absent and the glumes

Plate 99.
HEAD OF HONEY SWEET SORGHUM.

are small and reddish brown to dark straw in colour. Grains are definitely small, elliptical in shape and are well exposed on top; they are typically a medium brown. This variety is very juicy and sweet, and in spite of its earliness has shown its ability to carry over well into the winter. Under most conditions it will not yield as heavily as the later-maturing varieties, but the palatability of its fodder plus its ability to stand after maturity make it a favourite with nearly all farmers who have tried it. Italian is a better variety for close planting than the taller, coarser varieties.

Honey (Plate 99).

This is probably the most individual of all the varieties in this group, particularly in its appearance during the heading period. It is a fairly tall variety (7 feet to 9 feet), and one of the latest of all in its maturity. Stems are normally very stout and the foliage is heavy and broad. Plants are both juicy and sweet, but under rank growing conditions may be less sweet than Sugardrip or Italian. The variety tillers quite freely, making a very heavy bulk under favourable conditions. Stem-branching may be absent or quite free, according to the season. The head or panicle is extremely open, with long, drooping branches like those of broom millet; examples may exceed 15 inches by 8 inches in dimensions. This is the only common sweet sorghum in which awns are present, and even these are largely deciduous at maturity. Glumes are an attractive shiny reddish brown with few hairs, and they totally enclose the small seed. The seed when freed from its glumes is rather long, elliptical, and flattish, and is a buff to medium brown in colour. As, however, the glumes or hulls usually remain attached to the seed, they serve to distinguish it very easily from that of any other variety. Honey is capable of very heavy yields under favourable conditions, but is less productive than a number of other varieties in the drier districts. It has for many years been favoured for green feed in coastal districts, where it frequently outyields other varieties, and has also given good yields on the Atherton Tableland and in North Queensland generally. Honey is not recommended for standing over into winter because, (1) it may be very subject to red spot, and (2) it may become very coarse and woody as maturity is reached.

Other Varieties.

Queensland farmers are not likely to encounter many true varieties other than those described above. One group, however, which is well known throughout the world is the Sumac group. Sumac is a tall-growing, leafy variety not unlike Saccaline in its habit and period of maturity. It is easily distinguished by its compact heads well filled with small grain of a dark brownish red colour. This variety is quite succulent and sweet, but is very subject to red spot, and also lodges badly.

Early Sumac is an early-maturing selection from Sumac, which is shorter than the parent variety; its seed heads and seed are very similar to those of Sumac. If sown at closer spacings this variety should prove the most suitable for mowing, or harvesting with the reaper and binder. It also produces a useful re-growth after cutting.

Dwarf Ashburn is a midseason variety, which is also very productive and very palatable. It is closely allied to the Sumacs and is intermediate in season between Early Sumac and Sumac.

Jones is a tall variety with fairly stout stems, which is capable of high yields of attractive feed. It is very subject, however, to stem lodging, and this twisting and bending of the stems makes harvesting very difficult.

Many other varieties, including members of the Orange group, Colman and Leoti, have been tested in Queensland, but cannot be recommended for local use.

SUDAN GRASS.

Description.

Sudan grass is a native of tropical North Africa, which is now extensively used as a grazing and hay crop in most of the subtropical regions of the world. In Queensland it has become one of the most popular summer grazing crops for the sub-coastal and inland districts.

Sudan is a tufted grass which stools very freely, and may reach a height of 6 to 10 feet when in head. Stems and foliage are very fine in comparison with those of grain or sweet sorghums. While in widely spaced rows the stems may reach a diameter of ¼ inch, under normal conditions of heavy stand they seldom exceed ⅛ inch. Leaves are abundant, ranging in length up to about 2 feet, and averaging ½ inch to ¾ inch in width. The root system of Sudan grass is completely fibrous, with no development of the long white underground rootstocks which characterise the closely related Johnson grass. Sudan grass heads within 6 to 9 weeks of sowing, and the head is a widely branched open panicle which is typically conical in shape. The seeds are small in comparison with any of the sorghum varieties and are normally retained within the glumes or hulls. The small kernels are markedly elongated and are inclined to be pointed at both ends.

Sudan grass is frequently regarded as a biennial and has even been known to persist into a third season. It is normally treated in Queensland, however, as an annual summer crop, because stands are liable to be thin, weedy, and relatively unproductive during the second season. Its use is largely restricted to areas of medium or low rainfall, as under wet conditions the prevalence of "rust" and red-spot diseases may largely ruin the crop for either grazing or hay.

Planting and Cultivation.

The necessity for the use of seed of known origin and of a high standard of quality has already been emphasised. Johnson grass is one of our most serious pests of cultivation, and as its seed is very similar to that of Sudan grass the risk of introducing it in Sudan grass seed must never be overlooked. Moreover, hybrids of Sudan grass with Johnson grass or sorghums are regarded as being far more likely to develop poisonous properties than is pure Sudan grass. The planting seed should therefore have been harvested from a pure crop of Sudan grass which was separated by half a mile or more from the nearest plants of grain sorghum, sweet sorghum or any other grass sorghum.

Seed is usually planted in Queensland on a well prepared seed-bed, using the combine or seed drill. With this crop it is recommended that every grain run be used, as such block-sowing promotes finer stemmed plants which are more readily eaten by stock and are better suited for haymaking. Planted by this means, 8 lb. of sound seed per acre will give a very satisfactory stand, but planting rates of 10 to 12 lb. per acre are

more common. Where the seed is broadcast, somewhat higher rates may be advisable, but it should not be necessary to exceed 15 lb. per acre. Where Sudan grass is grown for pure seed production it is suggested that a row spacing of 21 inches or 28 inches be used, to allow of inspection of the crop and roguing where necessary.

Where the crop is block-sown or broadcast, there is no scope for further cultivation except possibly for a harrowing of the young crop, which procedure has frequently been found beneficial. Where a crop has been grazed to the ground or cut for hay during the midsummer period, a further harrowing of the stubble to loosen and a rate the soil will improve the prospects of a useful ratoon crop.

Utilisation of the Crop.

The great bulk of the Sudan grass grown in Queensland is intended for grazing by dairy cattle. The crop is also grazed by beef cattle and sheep, but to a lesser extent than by dairy stock. The crop is also used for haymaking and occasionally for ensilage.

Although the dictum that crops are not safe for feeding until they have reached the heading stage applies equally to Sudan grass as to other sorghums, it is very little heeded by most growers. Dairymen habitually graze their cows on Sudan grass at all stages of growth, and particularly during the early stages when the feed is most succulent and nutritious. The risk of stock losses following this procedure has been shown in Queensland and many other countries to be remote, provided (1) pure seed of a known reliable strain of Sudan grass is used, and (2) reasonable precautions are taken. Precautionary measures have already been suggested in the section on poisonous properties of sorghums. The grass makes rapid recovery after grazing, and several grazings may be obtained during a favourable growing period.

When harvesting for hay or ensilage, the crop should be cut at the flowering stage before the plants have become dry and fibrous. The operation is most efficiently carried out by means of the reaper and binder. When cutting for hay, the bundles should be made small, as bulky sheaves require a long drying period and are difficult to cure satisfactorily in the field. Sudan grass hay is of very fair quality, particularly if cut at the optimum time and before leaf blemishes have become prevalent. The quality of Sudan grass silage is also very satisfactory, and these two methods of conservation are strongly recommended in the drier agricultural districts of the State. Two to three cuttings may be expected during a reasonable season. Where a better balanced forage or hay is required, the crop should be sown with a fairly early maturing legume, such as Groit or Victor cowpea, broadcast at the rate of 4 to 5 lb. per acre.

Under good growing conditions yields of green feed up to 12 tons per acre are readily attainable on the first cut, but yields of 8 to 10 tons would be far more common. Hay yields of 2 to 3 tons per acre for the main cutting should result from good average crops in the inland dairying districts.

Harvesting for seed is carried out by means of the header-harvester after the grain has thoroughly matured within its hulls. Crop lifters may be required if lodging is at all serious in the mature crop, and the fan blast should be reduced, if necessary, because of the

relative lightness of the seed. Seed yields are light compared with those of the other sorghum groups; yields of 10 to 12 bushels per acre would be regarded as satisfactory under most conditions, but yields of 20 to 25 bushels per acre have at times been realised.

Varieties.

While varieties of Sudan grass have not been generally recognised in the past, definite differences between types have been known to exist, and steps are now being taken to establish varietal types (Plate 100). The first of these named varieties, Roma, has been in production in Queensland for a number of years. The second, Sweet Sudan, is a recent importation which has not yet been thoroughly tested but which promises to play a useful role in this State.

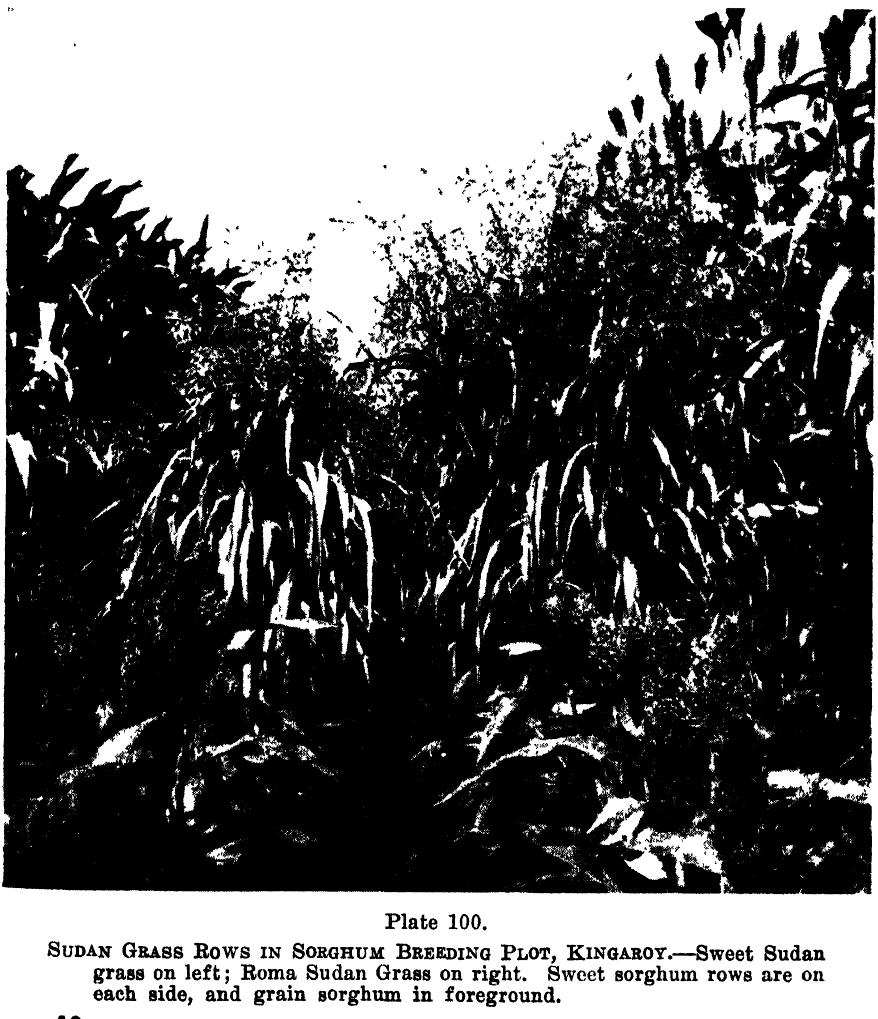


Plate 100.

SUDAN GRASS ROWS IN SORGHUM BREEDING PLOT, KINGAROY.—Sweet Sudan grass on left; Roma Sudan Grass on right. Sweet sorghum rows are on each side, and grain sorghum in foreground.

Roma.

Roma is a productive, tall-growing Sudan grass which stools very freely and provides good grazing. Although no sweeping claims can be made with respect to its freedom from poisonous properties, it is recorded that crops of this strain have been grown for many years in southern Queensland and grazed at all stages of growth with no known cases of stock loss. Chemical tests made at weekly intervals on a small planting in the Brisbane district during the summer of 1948-49 showed that the prussic acid content was negligible during the whole period of the test. Heads are large and very spreading, and are prominently awned or bearded. The hulls, which completely enclose the grain, are shiny and straw-coloured; occasionally they may be blotched or partly coloured with brown, but it is the predominantly light colour of the hulls which distinguishes this variety from most other seed lots. The kernel when stripped of its hulls is long and narrow, tapering to a blunt point at both ends; its colour is medium to dark brown. This variety has been included within the Department's seed certification scheme, and its spread throughout Queensland should be of considerable benefit to all farmers who use this crop.

Sweet.

This variety was developed in the United States from a cross between a standard Sudan grass strain and a sweet sorghum, Leoti. The object of the cross was to produce a plant similar to Sudan grass in its growth and general habit, but possessing also a sweet sap and carrying resistance to the bacterial red spot diseases. The resulting selection is unmistakably a Sudan grass in its appearance, but is less tall than Roma when grown under similar conditions. The plants stool very heavily and produce an abundance of leaf; these factors, coupled with its sweetness and high palatability, should make it a very attractive fodder or grazing plant. Sweet Sudan has somewhat smaller heads than Roma, the branches being shorter and less widely spaced. Awns are present, though relatively short, and the glumes or hulls are a glossy reddish brown in colour. The kernels are distinctly larger than those of Roma, due mainly to their greater broadness and plumpness in relation to their length, and are lighter in colour. This variety is readily identified from other varieties of Sudan grass by the size of its kernels and the distinctive colour of its hulls. Considerable claims have been made for this new variety in the country of its origin. In Queensland it has so far been subjected merely to exploratory trials, and in such trials its appearance has been quite promising. When tested for prussic acid content during the 1948-49 summer, it proved slightly higher throughout than Roma, though at no stage was it at all dangerous for feeding. A small trial in the Brisbane area also showed that it may not ratoon as well as Roma, particularly in the colder weather. If this variety does prove itself a safe and suitable crop for Queensland conditions, it will be rapidly multiplied and made available to farmers.

PESTS AND DISEASES.

Grain sorghum is liable to be attacked by a number of insect pests, some of which may very seriously affect yields. Some of these are pests of other agricultural plants also. The insects that may damage the growing crop include sorghum midge, corn ear worm, yellow peach moth, locusts and grasshoppers, and the grain aphid; while a grain moth and rice weevil may infest the harvested grain and cause serious losses in storage.

By far the most important of the several pests is the sorghum midge, which attacks the crop only at the flowering stage. Injury is caused to the developing grain and damaged heads are wholly or partially sterile, resulting in a correspondingly reduced grain production. Broom millet, Sudan grass, sweet sorghums and Johnson grass are similarly attacked. Crops which produce heads before midge populations become high in late summer and autumn suffer little damage. Economic control of the sorghum midge cannot yet be obtained with insecticides, and losses can be reduced only by correct cropping practices and by clearing up crop residues. Among other things, plantings should be so arranged as to give early and uniform maturity of the crop.

Diseases of sorghum are not as serious as the insect pests but can cause considerable reduction in yield if simple precautions are neglected. The most common disease in grain sorghum is covered kernel smut. Spores of the fungus which causes this trouble are carried on the seed. Control is readily effected by treating the seed with one of the fungicidal dusts marketed for this purpose, and the treatment should be regularly used.

A number of leaf diseases of sorghum are widespread but seldom cause appreciable injury. Blight (caused by a fungus) and red spot (due to bacteria) can reduce the value of sweet sorghum in the moister areas. Varieties of sorghum show wide differences in susceptibility to these leaf spots, hence trouble can be avoided by the use of resistant strains.

These and other matters regarding pests and diseases of sorghum are dealt with more fully in leaflets which can be obtained from the Science Branch of the Department, officers of which have supplied these notes.

Tackling Erosion Problems.

An ever-increasing number of Queensland farmers were realising the importance and benefit of soil conservation, said the Minister for Agriculture and Stock (Honourable H. H. Collins) recently.

It was estimated that in a little over a year through Departmental help and guidance, 5,000 acres of valuable land had been saved by the adoption of soil conservation practices. Every farm treated had led to numerous requests from other district farmers for similar Departmental advice and assistance in the protection of their land. From the Kingaroy district, where 3,000 acres have been initially treated, applications for Departmental assistance to protect an additional 25,000 acres had been received.

Mr. Collins said that 20 soil conservation demonstration areas had been established in Queensland from the Darling Downs to the Atherton Tableland. Situated on private farms, they were used to show district farmers modern methods of soil conservation and how profitable production could be maintained when proper protection methods were practised. In addition, Departmental experts had advised hundreds of individual farmers on control measures most suitable for their particular farms.

Seed Inoculation of Legumes.

T. McKNIGHT, Pathologist, Science Branch.

OVER the last 10 or 11 years Queensland farmers have made increasing use of the service of the Science Branch of the Department of Agriculture and Stock in providing cultures of nitrogen-fixing bacteria for inoculating seeds of legumes (that is, plants of the pea family), such as lucerne, cowpeas, lupins, and field peas.

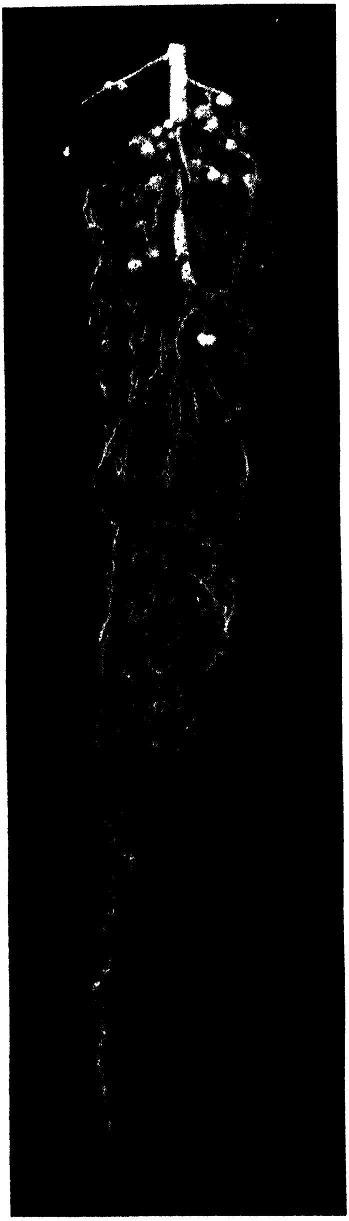


Plate 101.

ROOT NODULES formed by Nitrogen-fixing Bacteria on Poona Pea.

The importance of plants belonging to the legume family, apart from their cash value or the place they occupy in an agricultural programme, lies in the fact that they are able to obtain nitrogen from the air. They do this when the roots of the legume associate with nitrogen-fixing bacteria which form nodules on the root system (Plates 101 and 102.) Inside these nodules the bacteria obtain nitrogen from the air and pass it on to the plant, where it is utilized for growth. In this way, legume plants differ from all other plants grown by the farmer, which derive their nitrogen entirely from the soil. As the grower is well aware, the supply of nitrogen in the soil is frequently insufficient to produce the best possible plant growth. To make good this deficiency of nitrogen, legume plants fixing their own nitrogen may be grown instead of adding costly nitrogen fertilizers.

Varieties of Legume Bacteria.

The legume nitrogen-fixing bacteria are not all of the one type but may be divided into a number of varieties or species. Each of these species will form nodules on a certain group of legumes only and is unable to form nodules on plants outside its own specific group. For example, the lucerne species will form nodules and fix nitrogen on plants in the lucerne group only and will not form nodules on plants in the clover group or on plants in the cowpea, soybean, lupin, and other groups. The lupin bacteria will form nodules on lupins only. It is essential, therefore, to know just which legumes can be successfully inoculated with a particular culture of bacteria. The following classification of cultivated legumes shows the group relationships among the nitrogen-fixing bacteria.

CORRECTION.

The illustration on page 267 has been inadvertently printed upside down, so that the inoculated plant is now on the left.

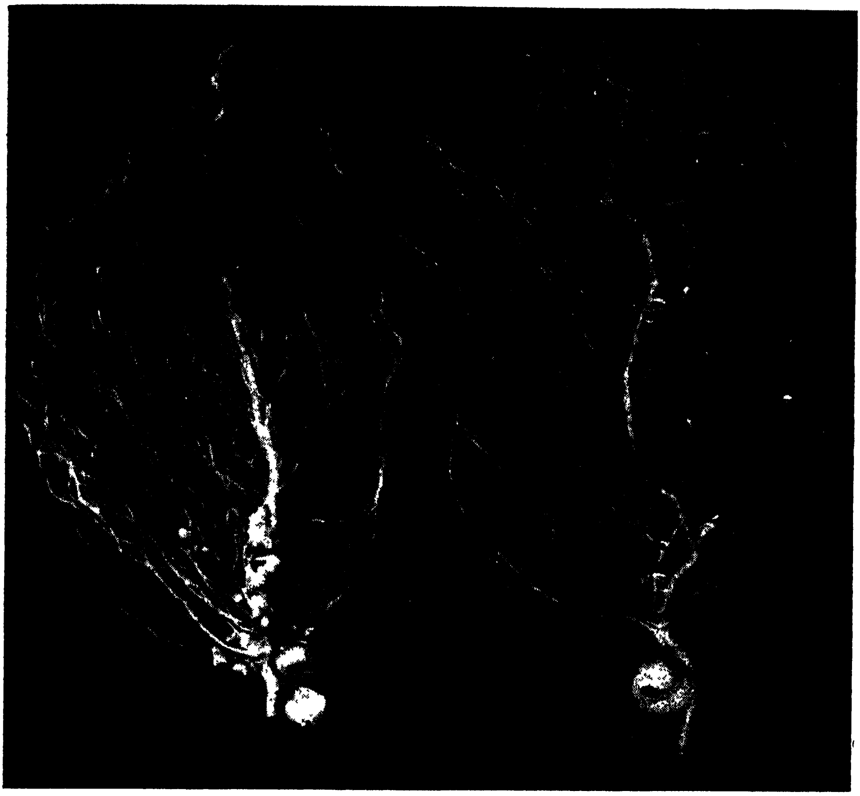


Plate 102.
GARDEN PEAS, SHOWING NODULES PRODUCED AS A RESULT OF INOCULATION. The plant on left is not inoculated. Old seed still attached.

LUCERNE GROUP.

Common Name.	Scientific Name.
Lucerne	*Medicago sativa*
Button clover	*Medicago orbicularis*
Burr medic	*Medicago denticulata*
Black medic	*Medicago lupulina*
White sweet clover	*Melilotus alba*

CLOVER GROUP.

Red clover	*Trifolium pratense*
White clover	*Trifolium repens*
Subterranean clover	*Trifolium subterraneum*
Berseem clover	*Trifolium alexandrinum*

COWPEA GROUP.

Poona pea, cowpea	*Vigna unguiculata*
Desmodiums	*Desmodium* spp.
Common or Japanese lespedeza ..	*Lespedeza striata*
Korean lespedeza	*Lespedeza stipulacea*
Perennial lespedeza	*Lespedeza cuneata*
Gambia pea	*Crotalaria goreensis*
Kudzu	*Pueraria thunbergiana*
Lima bean	*Phaseolus lunatus*
Peanut	*Arachis hypogaea*
Pigeon pea	*Cajanus indicus*
Velvet bean	*Stizolobium deeringianum*
Phasemy bean	*Phaseolus lathyroides*
Mauritius bean	*Stizolobium aterrimum*

SOYBEAN GROUP.

Soybean	*Glycine max*

GARDEN BEAN GROUP.

French and navy beans	*Phaseolus vulgaris*

PEA GROUP.

Field pea	*Pisum arvense*
Garden pea	*Pisum sativum*
Common vetch	*Vicia sativa*
Broad bean	*Vicia faba*
Sweet pea	*Lathyrus odoratus*
Tangier pea	*Lathyrus tingitanus*

LUPIN GROUP.

New Zealand blue lupin	*Lupinus angustifolius*
Garden lupin	*Lupinus pubescens*

Even among the different species of nitrogen-fixing bacteria, "strains" exist which vary in their ability to benefit the plant (Plate 103). An endeavour is made by the Science Branch when providing

Plate 103.

SHOWING VARIATION IN EFFICIENCY OF STRAINS OF THE RED CLOVER NITROGEN-FIXING BACTERIA. C, not inoculated; 15, inoculated with an inefficient strain; 16, inoculated with a strain of medium efficiency; 46, inoculated with a strain of high efficiency.

cultures of bacteria to growers to use only those strains which have been tested and found to fix nitrogen efficiently.

What to Expect from Seed Inoculation.

The value of seed inoculation is dependent on soil conditions, climatic conditions, cropping systems and fertilizing systems.

Given good moisture at the time of planting in soils that are low in nitrogen but satisfactory with regard to other plant foods, marked benefit generally follows the use of inoculated seed. Inoculation may mean the difference between success and failure of the crop on some of the poorer coastal soils where nitrogen is low and from which the appropriate strain of bacteria is absent. Such results, however, are the exception rather than the rule and more often smaller differences, of the order of 5 to 10 per cent., may be realized on a wide variety of soil types. The farmer should appreciate that such an increase in a field crop over a considerable acreage well repays the slight effort involved in inoculating the seed.

When the soil has been previously cropped successfully to the particular legume, or where the soil nitrogen supply is adequate due to fertilizing, cropping practices or natural fertility, the grower should

not look for improvement from seed inoculation. Growers are well aware that there are many hazards other than an inadequate nitrogen supply in the culture of legumes. The seed inoculation process is designed solely to ensure the presence of the beneficial nitrogen-fixing bacteria. Inoculating the seed will not ensure a successful crop, and under some soil conditions is no guarantee of the development of an adequate number of nodules. The grower can, on his own farm, determine fairly accurately the value of inoculating the seed by leaving a small but representative plot uninoculated for comparison purposes. If the plants in the uninoculated area grow equally well and have adequate root nodules, then inoculation is apparently unnecessary.

How to Obtain Cultures.

Farmers requiring cultures should write, indicating the variety of seed and the quantity to be treated, at least 10 days before sowing is anticipated, as that time is necessary for the preparation and despatch of cultures.

Cultures are issued in bottles of two sizes—large bottles to treat three bushels of seed; small bottles to treat one bushel of seed. With small seeds such as lucerne and clover the smaller bottle treats 30 lb. of seed and the larger 90 lb. A nominal charge of 1s. per bottle is made irrespective of size. It is desirable that remittances be forwarded with order. Small remittances should preferably be sent by postal note. All remittances should be crossed and made payable to "Under Secretary, Department of Agriculture and Stock." Orders for cultures should be sent to the Brisbane office of the Department.

The Culture.

The cultures are supplied in medicine bottles plugged with cotton wool. In the bottles the bacteria may be seen as an uneven whitish slime growing on the sloping surface of a jelly. Store the culture in a cool, dark place, and do not remove the cotton wool plug from the bottle until the culture is to be used. The culture may be used at any time up to six weeks after date of receipt. During transit in the post the jelly may be broken into pieces but this has no harmful effect on the bacteria.

Directions for Inoculating the Seed.

The inoculation process is simple, consisting merely of wetting the seeds with a suspension of the bacteria in skim milk to which a small quantity of calcium phosphate has been added.

1. Mix the calcium phosphate supplied in the packet with skim milk. Use the quantity of skim milk printed on the packet.

2. Transfer the bacterial slime from the surface of the jelly in the bottle to the mixture. To do this, pour a little of the milk into the bottle and, putting the thumb over the mouth of the bottle, shake vigorously; then pour back into the rest of the mixture. Repeat this several times until all the bacterial slime has been washed off the jelly.

Note.—The jelly is only the medium on which the bacteria live and it need not be removed from the bottle. While shaking the bottle to remove the bacterial slime the jelly will be broken up. This is of no importance and the larger pieces may be picked out with the fingers and discarded. Do not apply heat to dissolve the jelly.

3. Pile the seed on a clean surface and pour the mixture over the seed, a little at a time, thoroughly mixing the seeds with the hands while doing so to ensure that every seed is wetted.

4. Spread the seed in a cool, shady place to dry.

Sowing.

Inoculated seed should be sown within two days of inoculation. The best practice is to inoculate the seed in the afternoon and to sow the next morning in a moist seed bed.

Exposure to sunlight kills the bacteria, so seed should be drilled in, or, if broadcast, harrowed in soon after. Contact with artificial fertilizers (such as superphosphate) will destroy the bacteria. Fertilizer should be applied separately a day or two before planting, or the seed and fertilizer should be run through separate drills if sowing and fertilizing are carried out together.

Team for Pineapple Work.

An important co-ordinated scheme for improved Departmental services to the pineapple industry, a feature of which is investigations aimed at developing the industry in North Queensland, has been announced by the Minister for Agriculture and Stock (Honourable H. H. Collins).

A team of eight officers from the Science and Horticulture Branches of the Department will concentrate on research and advisory work on pineapples in an effort to increase yields, lower production costs, ensure greater efficiency in the industry, and, by demonstrating better handling methods in marketing the fruit, obviate wastage and financial loss.

Mr. Collins said that the pineapple industry was particularly important today because it is dollar earning, with Canada offering a big market for the canned product. Besides providing better services for established growers the new arrangement would give the many ex-servicemen who had entered the industry the advantage of the best possible advice on their undertaking.

Mr. R. C. Cannon will be in charge of the Departmental team. The field advisory work will be supervised by Mr. P. Mitchell (Senior Adviser in Horticulture), with whom will be associated officers at Nambour, Caboolture and Gympie. Experimental work on pineapples in North Queensland will be in charge of Mr. E. P. Williams, who is also a Senior Adviser in Horticulture. Various field and other investigations will be carried out at the Ayr Regional Experiment Station and other centres. Among the most important of these will be investigations concerned with the cost of production of pineapples in North Queensland and the practicability of growing the crop economically for canning in that part of the State.

Mr. Collins added that Mr. H. M. Groszmann of the Department's horticultural staff at Nambour, has practically completed the current programme of developing superior pineapple types, and planting material of these should be available to growers shortly.

Lime for Agricultural Purposes.

F. B. COLEMAN, Standards Officer, Standards Branch.

(*Continued from page* 136 *of September issue.*)

LIME CARBONATES.

Pulverised Limestone, Pulverised Marble, Pulverised Coral, or **Pulverised Shells** are the respective natural materials after treating by passing through a crushing or pulverising machine.

The percentage of lime (CaO) varies according to the purity of the original material; the lime is in the form of calcium carbonate. *Pulverised limestone* varies in quality, but, generally speaking, is a fairly high-grade source of lime. It must be ground in a pulverising machine, as is explained elsewhere under the heading of "*Fineness.*"

The degree of fineness is an important factor governing its value. The natural impurities usually present are chiefly magnesia, iron, alumina and silica.

Coral.—Coral lime can be obtained at low tide from reefs in the tropics by a process of quarrying aided by explosives.

It has in the past been loaded on barges, taken to the mainland, and pulverised; in certain cases it has been broken into pieces and burnt, as explained in the section on "Burnt Lime."

A product of coral formations found in shallow water in certain parts of the sea bed along the Queensland coast is also used as lime for agricultural purposes. This is handled by dredging, and although fairly dirty in appearance, it may be made to analyse fairly high in lime content by selection, washing, &c.

The lime is all in the carbonate form, as in the original coral. As fairly large pieces of coral are present, drying and grinding are necessary.

Earthy Lime consists of lime carbonate which is in a naturally disintegrated or friable condition, and is dug out after removal of the "overburden." It is comparatively impure and of a softer nature than limestone.

It sometimes needs very little treatment before being offered for sale, but to be sure that it complies with the fineness requirements of the Fertilizers Act, earthy lime should be ground and/or screened before being bagged.

The lime (CaO) content varies according to the purity of the material—as in pulverised limestone—and is wholly present in the form of calcium carbonate.

MAGNESIAN LIMES.

Magnesium or Dolomitic Lime Carbonates.—A number of natural limestone or earthy lime deposits contain an appreciable quantity of magnesia. When this type of material is marketed in Queensland the minimum percentage of magnesia (MgO) as well as the minimum percentage of lime (CaO) must be declared on the label for the information of the purchaser, who may decide from these percentages whether the product is suited for his particular purpose or otherwise. The neutralising value to which both the lime and magnesia contribute must be declared also. The percentage of lime (CaO) and magnesia (MgO) together found on analysis must total not less than 35 per cent.

Of course, practically all naturally occurring lime carbonates contain a small amount of magnesia.

Fineness is of the same importance with all of these carbonates.

It should be noted that the maximum percentage stated on the label refers to magnesia (MgO)—not magnesium carbonate ($MgCO_3$). This is comparable to the declaration of the percentage of lime (CaO) and not calcium carbonate ($CaCO_3$), as explained in the section on "Labels."

GYPSUM.

Gypsum is a naturally occurring form of lime, and may be described as dihydric calcium sulphate ($CaSO_4.2H_2O$).

It is very little used in Queensland, and although it has a minimum lime (CaO) content of 25 per cent., it has no neutralising value.

One such material is registered in Queensland under this name.

MISCELLANEOUS LIMES.

From time to time limes for agricultural purposes are placed on the market that owing to the quality of the material used, or difficulties involved in the process of manufacture or preparation, or other factors, do not compare with limes in the group to which they purport to belong.

In these cases they are classified as "miscellaneous" to allow purchasers to value them on their own merits apart from any group in which they would appear out of line.

NEUTRALISING VALUE.

The term neutralising value applies to all limes for agricultural purposes, except gypsum, and affords a means of comparison applicable to these limes.

It is a comparative figure which denotes the ability of the lime in question to neutralise acidity, which is one of the main purposes for which lime is used.

It is a figure ascertained practically, and would include any other carbonates or basic materials present.

The standard of comparison is 100 per cent. pure calcium carbonate, which would have a neutralising value of 100.

Comparative neutralising values would be:—

Burnt lime	160
Slaked lime	120
Pulverised limestone	90
Processed lime	86
Earthy lime	80

FINENESS.

With respect to lime sold for agricultural purposes, fineness is of importance with earthy lime, pulverised limestone, pulverised marble, and other pulverised carbonates, and also processed lime.

Magnesian limes are, of course, included here.

"Fine" means particles that will pass a sieve with apertures $\frac{1}{100}$ inch square.

The whole of the limes to which fineness applies must pass a sieve with apertures $\frac{1}{8}$ inch square.

Burnt lime is not affected by fineness, and the resultant slaked lime is also exempt from this provision.

Carbonates with equal neutralising values may be compared on a fineness basis.

The reason why fineness applies to earthy lime, processed lime, pulverised limestone, and other pulverised carbonates, and not to burnt or slaked lime, may be set down as follows:—

It has been repeatedly proved that lime carbonates, unless in a fine state of division, are not rapidly absorbed by the soil, being insoluble in pure water and only slowly soluble in slightly carbonated water—that is, water containing carbon dioxide in small quantity.

The following extract from a bulletin prepared by H. W. Kerr and C. R. von Stieglitz—"The Value of Different Forms of Lime"—is not only well worth repetition but should be very carefully borne in mind by every lime purchaser:—

> "Other things being equal, the finer the condition of the agricultural lime, the quicker will favourable results be obtained. Particles coarser than $\frac{1}{20}$ inch in diameter are practically worthless, and in a country where lime costs are so high the farmer should pay particular attention to this consideration."

Artificial grinding (or screening) is therefore necessary with these materials.

Burnt lime, however, is in large lumps when sold, and of its own accord breaks down on slaking—either artificial or natural—to a fine powder. This powder being usually largely hydroxide when applied, is fairly water-soluble and is absorbed readily by the soil. Also, the fineness of the powder is greater than could be obtained by normal grinding processes.

No artificial grinding is therefore necessary, and a fairly uniform absorption by the soil is obtained from all burnt or freshly slaked limes.

The table at the end of this article sets out the various limes being offered for sale within the State.

GROUP NAMES.

The use of names indicating the groups to which the particular limes relate is of importance.

For instance, a purchaser uses the name "Burnt Lime." Now, providing names used are a correct indication, any burnt lime registered would have a neutralising value that should be associated with burnt lime, e.g., say, at least 160.

If he orders a pulverised limestone, irrespective of "specific designation," he would get a material with a neutralising value of, say, at least 90, and with earthy lime, say, 70 to 90.

In addition, with the use of the name "Burnt Lime," he can dispense with fineness, whereas, with pulverised limestones, earthy limestones, &c., he has two factors of importance—neutralising value and fineness.

In short, limes may readily be compared with other limes in their own respective groups, and the strict adherence to this grouping with respect to the names used on the labels is of importance in allowing this comparison to be easily made.

LABELS.

The method of labelling lime with respect to lime content (as indicated in the table) is as follows:—

The percentage or percentages of lime (CaO) and the respective forms in which it occurs must be stated. This means that, with slaked limes or carbonates, not the percentage of calcium hydrate and percentage of calcium carbonate should be stated, but the percentages of calcium oxide—lime (CaO)—that are present in each of these forms.

Let us take a partially air-slaked lime for an example. This may consist actually of—

50 per cent. calcium oxide,

40 per cent. calcium hydroxide, and

5 per cent. calcium carbonate,

with, say, 5 per cent. impurities.

Now, in the calcium hydroxide and calcium carbonate only the percentages of calcium oxide (CaO) can be called active constituents.

To compare with burnt lime containing, say, 90 per cent. lime (CaO), all as calcium oxide, this lime must be reduced to a common basis. In other words, to compare with a material that has lime present only as calcium oxide (CaO), the percentages of calcium hydroxide and calcium carbonate must also be reduced to the amount of calcium oxide (CaO) that they contain—the forms in which the calcium oxide (CaO) occurs being, of course, also stated.

Thus, the label would read—

50 per cent. lime (CaO)	as calcium oxide
30 per cent. lime (CaO)	as calcium hydroxide
2·8 per cent. lime (CaO)	as calcium carbonate
Total 82·8 per cent. lime (CaO).	

On this figure the material can then be compared with any other lime on a total lime (CaO) basis.

Of course, the neutralising value gives a definite method of comparison, but it includes magnesia and other neutralising material, and is a comprehensive figure only; also, the neutralising value does not indicate the form or forms in which the calcium oxide occurs, and is of value only with respect to neutralising soil acidity.

It is provided by the Fertilizers Act that all limes for agricultural purposes shall be labelled in such a manner as to set out:—

The kind of lime;

The percentage of lime (CaO) and the form or forms in which it occurs;

The maximum percentage of magnesia (MgO);

The neutralising value;

The net weight;

The percentage of fineness (except in the case of lime which has been burnt); and

The name and address of the manufacturer or dealer.

The following sets out examples of labels:—

BURNT LIME FOR AGRICULTURAL PURPOSES.

When packed, lb. net.

90 per cent. lime (CaO) as Calcium Oxide.

Neutralising Value, 160.

(Name and Address of Manufacturer or Dealer.)

PULVERISED LIMESTONE FOR AGRICULTURAL PURPOSES.

When packed, lb. net.

50 per cent. lime (CaO) as Calcium Carbonate.

Neutralising Value, 90.

Fine, 80 per cent. Coarse, 20 per cent.

(Name and Address of Manufacturer or Dealer.)

EARTHY LIME FOR AGRICULTURAL PURPOSES.

When packed, lb. net.

45 per cent. lime (CaO) as Calcium Carbonate.

Neutralising Value, 80.

Fine, 65 per cent. Coarse, 35 per cent.

(Name and Address of Manufacturer or Dealer.)

MAGNESIAN EARTHY LIME FOR AGRICULTURAL PURPOSES.

When packed, lb. net.

43 per cent. lime (CaO) as Calcium Carbonate.

7 per cent. Magnesia (MgO) as Magnesium Carbonate.

Neutralising Value, 85.

Fine, 60 per cent. Coarse, 40 per cent.

(Name and Address of Manufacturer or Dealer.)

This article deals only with the legislation controlling the sale and quality (both chemical and physical) of the various limes for agricultural purposes that are sold within this State.

Any information desired as to the actual use or application to the land for specific purposes should be directed to the branches of the Department that are concerned.

SUMMARY.

The chief original source of lime for agricultural purposes in Queensland is limestone rock.

The principal kinds of lime derived from this are as follows:—

Burnt Lime.—This is made by burning lumps of limestone, and providing it is packed and railed when freshly burnt is a "concentrated" source of lime. It is to the farmer's advantage to slake burnt lime on his own property. Unfortunately the distribution of slaked lime is a very disagreeable undertaking. Ground burnt lime allows the application to be made by machine in one operation, eliminating most of the objections.

An average quality burnt lime should analyse—

90 per cent. lime (CaO) as calcium oxide, and neutralising value, 160.

Processed Lime is the resultant by-product obtained after burnt lime has been used in certain chemical processes; the lime (CaO) is chiefly in the form of carbonate.

An average quality processed lime should analyse:—

46 per cent. lime (CaO) as calcium carbonate, neutralising value, 86; fine, 50 per cent.; coarse, 50 per cent.

Pulverised Limestone is the original rock quarried and ground. An average quality material should analyse:—

50 per cent. lime (CaO) as calcium carbonate, neutralising value, 90; fine, 80 per cent.; coarse, 20 per cent.

Other important limes for agricultural purposes are:—

Earthy Lime, which is an impure form of lime carbonate that can easily be worked by digging, being softer than limestone, and usually requiring screening only. An average quality material should analyse:—

45 per cent. lime (CaO) as calcium carbonate, neutralising value, 80; fine, 65 per cent.; coarse, 35 per cent.

Magnesian Limes for Agricultural Purposes, which are pulverised limestones or earthy limes containing appreciable quantities of magnesia.

The minimum percentage of magnesia (MgO) as magnesium carbonate as well as the minimum percentage of lime (CaO) as calcium carbonate must be declared on the label, and this should be considered by the farmer with a view to the application of the material for particular purposes.

Efficiency of Lime for Agricultural Purposes.—Limes which have been burnt may be compared on a neutralising value basis only.

Other forms of lime may be compared within their own respective groups on a neutralising value and fineness basis, except where the percentage of magnesia is appreciable, when this must be treated as another important factor.

Labels should set out the—

Kind of lime;

The percentage of lime (CaO) and forms in which it occurs;

The minimum percentage of magnesia (MgO);

the neutralising value;

The net weight;

The fineness (unless prepared by burning);

The name and address of the manufacturer or dealer.

Buyers of lime of a greater value than 10s. should receive an invoice bearing the warranty required by the Act with respect to the quality of the article.

On no account should purchasers accept delivery of lime for agricultural purposes that is not labelled and invoiced in the manner outlined above.

All complaints or inquiries should be addressed to the Standards Branch, Department of Agriculture and Stock, Brisbane.

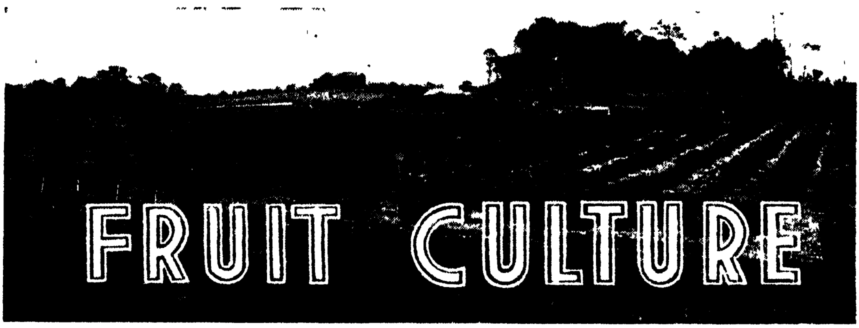
LIMES FOR AGRICULTURAL PURPOSES.

REGISTERED UNDER "*The Fertilizers Act of* 1935," AS AT 10TH JUNE, 1949.

Name and Address of Dealer.	Brand.	Guaranteed Analysis.					
		(CaO) Lime.	In the Undermentioned Form.	Magnesia (MgO) as Magnesium Carbonate.	Neutralising Value.	Fine.	Coarse.
		Min. %		Min. %	Min.	Min. %	%
Burnt Lime—							
A.C.F. and Shirleys Fertilizers Limited, Brisbane	A.C.F.	90	As Oxide	..	160	..	..
Ambrose Lime Works, Ambrose	Ambrose	90	As Oxide	..	160	..	..
Crotty Lime Works, Ootan	Crotty	90	As Oxide	..	160	..	..
Ryan Lime Company (Pty.) Limited, Calcium	Ryan	90	As Oxide	..	160	..	..
Tamaree Lime Works, Gympie	Tamaree	82·5	As Oxide	..	151	..	..
Burnt Lime—Pulverised—							
Ryan Lime Company (Pty.) Limited, Calcium	Ryan	85	As Oxide	..	150	..	..
*Slaked Lime—							
Tamaree Lime Works, Gympie	Tamaree	2·5 34·3 18·6	As Oxide As Hydroxide As Carbonate	..	124	..	..
Processed Lime—							
Australian Chemical Company (Pty.) Limited, South Brisbane	Acco	47	As Carbonate	..	88	35	65
Fertiliser Distributors Pty. Limited, Brisbane	F.D.L.	47	As Carbonate	..	88	50	50
Mewing and Sons, T., Brisbane	Processed Lime	47	As Carbonate	..	88	50	50
Pulverised Limestone, Marble, &c.—							
A.C.F. and Shirleys Fertilizers Limited, Brisbane	A.C.F.	50	As Carbonate	..	90	50	50
Ambrose Lime Works, Ambrose	Ambrose	50	As Carbonate	..	90	84	16
Crotty Lime Works, Ootan	Crotty	51	As Carbonate	..	92	77	23
Fertiliser Distributors Pty. Limited, Brisbane	F.D.L.	50	As Carbonate	..	90	84	16
Marberite Company Pty. Limited, Brisbane	Farmers	55	As Carbonate	..	99	75	25
Northern Lime Co., Mossman	..	50	As Carbonate	..	90	65	35
Queensland Pastoral Supplies Pty. Limited, Brisbane	Hibiscus	52·4	As Carbonate	..	95	75	25
Richards and Sons, H. J., Toowoomba	Agricultural	50	As Carbonate	..	90	60	40
Ryan Lime Company (Pty.) Limited, Calcium	Ryan	50	As Carbonate	..	85	50	50

*Also Limil—*see* Hydrated Lime.

Earthy Lime—							
Inkerman Lime Company, Home Hill	Magnesium Earthy	43	As Carbonate	7	85	60	40
Ryan Lime Company (Pty.) Limited, Calcium	Ryan .	44	As Carbonate	..	78	65	35
Webb and Webb, Reid River	..	42	As Carbonate	..	75	65	35
Magnesium Lime—							
The Poultry Farmers Co-operative Society Limited, Brisbane	Red Comb .	21	As Carbonate	18	78	60	40
Hydrated Lime—							
Brett and Company Pty. Limited, Brisbane	Limil	65	As Hydrate	3·0	123	..	..
Miscellaneous Lime—							
Australian Plaster Industries Pty. Limited, Brisbane ..	Victor Gypsum	1·0	As Carbonate	..	..	..	..
		30	As Sulphate (Sulphur as trioxide 17%)			60	40



Horticultural Districts of Queensland.

2.—THE LOCKYER VALLEY.

A. M. RICHARDSON, Adviser in Horticulture.

THE valley of the Lockyer Creek, a tributary of the Brisbane River, includes the most compact and extensive area of irrigable alluvial soil in Queensland. It is about 40 miles long, two to 10 miles wide, and lies between the coastal ranges and the main Divide which passes through Toowoomba. The catchment area is approximately 1,000 square miles. The main creek is fed by tributary streams, including Laidley Creek, Tent Hill Creek, Ma Ma Creek and Flagstone Creek, which drain the coastal side of the Dividing Range. The main townships in the area are Laidley, Gatton, Helidon, Grantham and Lowood. All these towns, with the exception of Lowood, lie on or near the main road and rail links between Brisbane and Toowoomba. They are 300-600 feet above sea level.

CLIMATE.

The climate of the district may be classed as sub-coastal, and is mainly temperate in character. The rainfall averages just under 30 inches a year and about two-thirds of it falls during the summer months. However, sufficient rain normally occurs during the winter and spring to permit the growth of short-term vegetable crops such as tomatoes, peas and beans, even in the absence of irrigation. The mean maximum temperature is 88.7 deg. F. in December and 69.1 deg. F. in June. The higher temperatures occur during the relatively dry spring and early summer. The winter is cold and frosts are common. Cold westerly and south-westerly winds which sweep through the less sheltered areas sometimes play havoc with crops growing during the autumn, winter and spring. Windbreaks (Plate 104) are therefore desirable.

TABLE 1.

CLIMATIC DATA—LOCKYER VALLEY.

—	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Aver.
Mean Max. Temp. (F.)	88·9	88·0	85·0	80·9	74·4	69·1	68·9	71·9	77·9	83·6	87·6	88·7	80·4
Mean Min. Temp. (F.)	65·5	65·5	62·2	56·4	49·6	45·7	43·3	43·8	49·4	55·3	60·9	63·9	55·1
Average Rainfall (pts.)	412	346	317	189	155	192	132	114	157	200	280	363	2,857

Plate 104.
WINDBREAK OF EXOTIC PINES GIVES PROTECTION AGAINST WESTERLY WINDS.

SOILS.

The soils in the greater part of the Lockyer Valley are derived from the adjacent ranges, which are in part basaltic (e.g. the Macpherson Range) but largely sedimentary in origin. The soils of the valley are therefore variable in depth, texture and composition. Extensive areas in the vicinity of Gatton, Laidley and Lowood are deep, heavy, black clay loams overlying a sandy clay. Similar, though sometimes lighter, soils flank both the main creek and the tributary streams. Adjoining the alluvials are the foothill soils of varying slope, aspect and colour. Some of these are well suited to horticultural crops and are so used by many farmers.

The heavy black alluvial clay loams are neutral to alkaline in reaction. Normally, however, these soils are adequately supplied with plant nutrients, although a response to nitrogen can be expected with most fruit and vegetable crops. Care is needed to ensure the retention of a satisfactory soil structure when irrigation is practised over long periods.

The lighter soils of the foothills and some creek flats are less fertile than the heavy alluvials. Crops grown on these soils respond to complete fertilizers. Deficiency symptoms ascribable to boron and zinc have been noted with crops such as citrus. The light soils are easily worked, but annual or perennial cover crops should be grown when the land is not being cropped. Precautions against erosion are necessary on some slopes.

The area of irrigable land in the Lockyer Valley is estimated at 72,000 acres. About 80 per cent. of this can be classed as fertile. The balance, much of which is suitable for some fruit and vegetable crops, is of fair to poor quality.

Irrigation water is sometimes drawn direct from the creeks, but most farmers pump from wells which tap underground supplies at depths of 40 to 100 feet. A number of weirs (Plate 105) constructed

Plate 105.
WEIRS ASSIST FARMERS PUMPING DIRECT FROM LOCKYER CREEK AND RAISE THE WATER LEVEL IN WELLS USED FOR IRRIGATION.

on the Lockyer to conserve water have the effect of raising the water level in the wells. The underground water is on the whole suitable for irrigation but in some areas it tends to be saline, particularly during long periods of dry weather. Wells with salinity problems are usually near the upper reaches of some tributary streams. Pumps are powered by electricity, which is available at reasonable rates (about 2s. 6d. to pump one acre-inch) in at least the more closely settled areas. Overhead irrigation is more or less general and most of the better-known distribution systems are represented in the district.

VEGETATION.

In its virgin state the Lockyer Valley carried a variety of vegetation types. Rain forest occurred on alluvial soils fringing the creeks and also on foothills with good soil, adequate moisture and a warm aspect. The species distribution was normal for this type of country in southern Queensland. Elsewhere, with the exception of some small natural plain and treeless areas, the country could be classed as

savannah woodland. On the richer, well-drained forest alluvial soils, blue gums, bloodwood trees and Moreton Bay ash were characteristic. In the dry, sandy types of soil, spindly and free-suckering eucalypts grew freely, with grey box as the dominant type. Some of the poor ridgy country was covered with narrow-leaved ironbark.

Most of the better land in the Lockyer Valley has now been cleared but timbered pockets still remain in the less well developed areas and in sanctuaries under the Fauna Protection Act.

HORTICULTURAL USES.

The status of horticultural crops in the Valley is something of an enigma. The district has been settled for a long time. Good fruit and vegetable crops can be grown on the variety of soil types available and potential markets are close. In spite of these facts, the area under horticultural crops is still comparatively small and production methods are, with some notable exceptions, less efficient than in other districts.

Citrus.

Most of the citrus orchards (Plate 106) are situated in the upper Lockyer and some of the original plantings made 60 years ago are

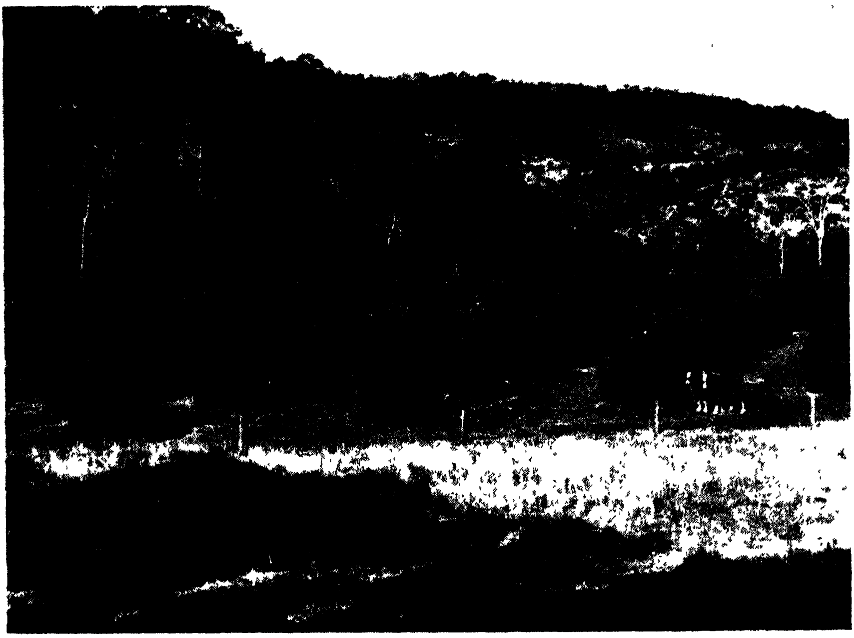


Plate 106.
CITRUS ORCHARD NEAR THE FOOTHILLS ON THE UPPER REACHES OF THE LOCKYER VALLEY.

still in production. Fine-textured irrigable soils on the north side of Helidon and Grantham, with a reputation for the production of high quality fruit, are being selected wherever practicable for new plantings. The main orange varieties grown are Washington Navel, Late Valencia and Joppa, but Siletta and Jaffa are represented in some orchards. Mandarins are not grown extensively, although small areas of Emperor, Ellendale and Glen Retreat varieties are in production.

In some respects, the soil and climate of the Lockyer differ from those of other citrus districts. Particular interest is, therefore, taken in stock-scion relationships, which have a bearing on both the quality of the fruit produced and the life of the orchard. Soil management problems are also responsible for original practices, one of which is the use of a surface mulch on non-irrigated orchards to induce consistent cropping in shy-setting varieties. The mulch, Sudan grass or some other bulky crop, is carted on to the orchard during the autumn.

Vines.

Vineyards are established at Coominya and Helidon on some well-drained soils in warm areas. These localities are relatively free from late spring frosts, which are a hazard to vignerons in some other areas. Early varieties, such as Royal Ascot and Muscat-Hamburg, are normally grown and the crop has proved payable.

Tomatoes.

The tomato crop is grown mainly on the warm foothills of the upper Lockyer and in rich hillside pockets elsewhere. Two crops are normally grown each year, an early crop which is planted in August and a late crop which is planted in January or February. The latter crop, though profitable if seasonable conditions are favourable, is rather speculative owing to the incidence of some wilt diseases which thrive in hot weather. Varietal preferences differ, but growers tend to use local seed selected from the varieties Rutgers and Valiant.

Other Fruits.

Melons are grown primarily for the summer market in both Brisbane and Toowoomba. They are planted on the rich creek loams and crops are usually good and very profitable. The principal variety is Kleckley Sweet.

Vegetables.

In the more important horticultural areas, cabbages, cucumbers, lettuce and other vegetables are grown regularly each year. Elsewhere in the Lockyer Valley, land which is not required for agricultural purposes is often sown to vegetable crops by shrewd farmers who sense the prospect of a bare market. For example, in 1948-49 late spring frosts upset Stanthorpe production schedules and some Lockyer farmers then immediately planted early maturing vegetables for marketing before the mid- and late-season crops were harvested at Stanthorpe.

Cabbages thrive best on the heavy, black soils at Grantham and Gatton. It is a common practice to seed the crop directly into the field and thin the rows of seedlings by hoe. Crops grown in this way yield heavily and compare favourably with normal market garden crops grown from seedlings transplanted into the field. The bulk of the crop is trucked direct from the farm to Toowoomba and other inland towns. The main varieties are Vanguard and Utility.

Lettuce are grown in winter and early spring, particularly for the Toowoomba market. Warm frost-free situations are chosen for this crop and the main variety grown is Imperial 615, which produces under these circumstances a small compact head. Returns to the grower from this crop are usually very good.

The cucumber is planted in early spring and harvested in summer. A number of varieties are grown but the most successful are Early Fortune and White Spine.

Horticultural Production.

Table 2 shows the estimated horticultural production in the Lockyer Valley in 1948-49.

TABLE 2.

ESTIMATED HORTICULTURAL PRODUCTION, LOCKYER VALLEY, 1948-49.

Crop.	Area.		Estimated Production.
	Acres.		
Tomatoes	36		7,777 $\frac{1}{2}$ bushel cases
Melons—Water	29		86 tons
Melons—Rock	4		14 tons
Cabbages	48		10,759 dozen
Lettuce	$\frac{5}{8}$		170 bushels
Cucumbers	16		1,158 bushels
	No. of Trees		
	Not Bearing	Bearing.	
Oranges	5,004	9,169	23,779 bushels
Mandarins	1,339	3,320	5,247 bushels
	Area- Acres.		
	Not Bearing	Bearing.	
Grapes—Table	13	69	224,684 lb.
Grapes—Wine	1	3	1,500 lb.

MARKET OUTLETS.

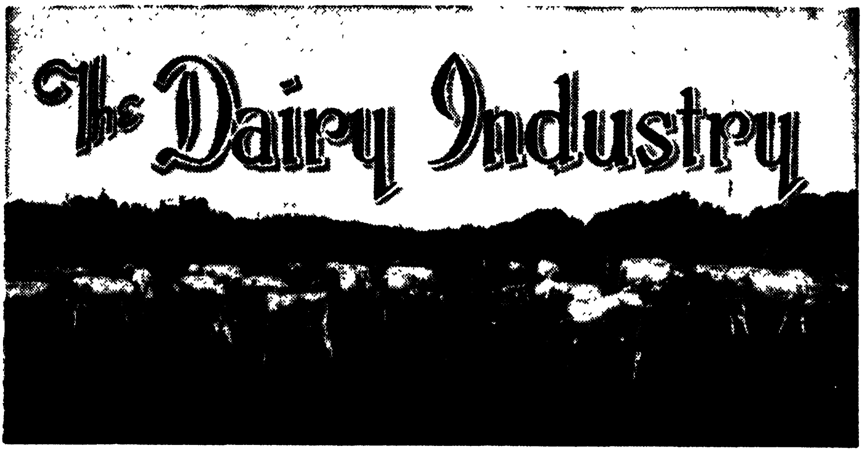
At the present time, the bulk of the fruit and vegetables produced in the Lockyer Valley has to be trucked from the farm and railed to the market. Most of it goes to Brisbane, but part is forwarded to Toowoomba and Sydney. Some growers, particularly fruit growers, not only supply the market but also conduct a substantial country order trade. With the more perishable vegetables, some deterioration takes place in transit to the Brisbane market. However, when improved methods of transport become available, Lockyer vegetable growers should be able to compete on better terms with producing areas nearer to the city.

THE FUTURE.

There is room for much expansion in horticultural enterprises in the Lockyer Valley. Future developments will no doubt follow the existing pattern of production, with tomato and vegetable production on the warm foothills of the Dividing Range and other frost-free areas where the soils are fertile and easily worked, citrus orchards on the deep sandy loams adjacent to the creek, and vineyards on the warm sandy soils at Helidon and Coominya.

One particularly attractive area at Spring Creek, north of Gatton, has so far scarcely been tapped for horticultural purposes. In this locality there are hundreds of acres of red, sandy loam with ample underground water for irrigation and well suited to both citrus and vines. Though somewhat isolated at present, good roads and other amenities must come to the area sooner or later as settlement proceeds. In the meantime, land values are reasonably low compared with those in the more closely settled areas.

There seems little doubt that fruit and vegetable growing in the Lockyer will some day become more important than at present. The rate of development may depend on the stimulus of marketing opportunities and the wider appreciation of the district's potentialities.



Detergents and Chemical Sterilizers.

D. S. ROBERTSON, Dairy Adviser.

CONFUSION appears to exist amongst many dairy farmers as to the meaning and use of detergents and chemical sterilizers in the dairy, and it is not uncommon to find the latter being used for the former and vice versa. The purpose of this article is to distinguish between detergents and sterilizers and acquaint farmers with the use of these preparations.

In a dairy sense, the function of a detergent is to remove milk deposits and other foreign matter from the surface of dairy equipment. A chemical sterilizer is used to kill any bacteria that may be present on the surface of otherwise clean dairy equipment.

How Detergents Act.

As previously mentioned, the function of a detergent is to remove milk deposits from the surface of dairy equipment, and for a substance to do this effectively it must possess certain well-defined properties. The milk deposit can be removed if a film of liquid can be forced between it and the surface to which it adheres, and as alkaline solutions wet the surface and form emulsions with fats they facilitate removal of milk residues. Hence all detergents in common use in the dairy are highly alkaline. The most common dairy detergents are caustic soda, washing soda, and proprietary dairy cleaners marketed under various trade names.

How To Use Detergents.

Before attempting to use a detergent, the dairy equipment should first be rinsed with cold water to remove all traces of milk. After this has been done, the equipment should be washed in sufficient water containing the correct amount of detergent, the temperature of the solution being just comfortable for the hands. If excessively hot detergent solutions are used they will hinder the cleansing effect by tending to precipitate casein and to cause gummy deposits to pack harder on to the metal surfaces. The prepared cleansers should always be used in the strengths recommended by the manufacturers,

who are aware of the chemical composition of the product. Other detergents, such as caustic soda or washing soda, should be used as advised by the local Dairy Officer or Adviser.

It is not sufficient to splash the detergent solution over the surface of the utensils. The scrubbing brush should be used vigorously to aid in the removal of fat and casein, and all pipes should be cleaned with a suitable pull-through brush. Scrubbing brushes and proper pipe brushes only should be used. Rags should find no place in dairy cleaning.

After thoroughly washing the equipment with the cleaning solution or detergent, all articles should be sterilized by means of boiling water or steam. If sterilization is practised, the equipment should first be rinsed with hot water to remove all traces of cleanser.

From the above it can be seen that a detergent is a "cleaner." Its sole use is to clean dairy equipment by removing milk particles, fat and dirt. It is not a sterilizer.

Chemical Sterilizers.

There are many chemical compounds which effectively destroy bacteria, but the majority are poisonous or taint milk and its products. For this reason they are unsuitable for dairy purposes. The choice is thus strictly limited and at present chlorine preparations are most commonly used, since they are effective sterilizers and in *dilute* solutions are not poisonous nor tainting to milk and cream.

Chlorine sterilizers are of two general types—namely, inorganic and organic compounds. To the inorganic group belong the hypochlorites of calcium and sodium. The organic chlorine compounds are represented by the chloramines, such as chloramine-T. The inorganic compounds, in the form of the hypochlorites, are the type in common use on Queensland dairy farms.

How Chemical Sterilizers Act.

Chlorine is the active sterilizing constituent in hypochlorite compounds. The solutions do not emulsify fats and unless the surfaces on which they are used have been previously cleaned with a detergent solution their action is impeded and they cannot sterilize effectively. Furthermore, these preparations should always be used in accordance with the printed directions on the tin or package, for the strength of the available chlorine may vary with different preparations. The most convenient way of handling these sterilizers is to make up a "stock solution" of the preparation, as directed by the manufacturer, and then bottle this solution in clean, dark bottles. A known amount of this solution, when added to a four-gallon bucket of clean water, will give a sterilizing liquid of the required strength. The bottles should always be kept in a cool, dark place, as heat and strong light will reduce the strength of the stock solution.

When to Use Chemical Sterilizers.

Chemical sterilizers should always be employed at least 20 minutes before using the dairy equipment. Their aim is to destroy any bacteria which may have gained access to the utensils between the time of cleaning and the time of use. The bacteria may be carried to the plant and utensils by dust, or the utensils may become contaminated

by contact with unsanitary draining racks. These preparations should not be applied immediately after using the plant, for prolonged contact with the metal will cause serious corrosion.

How to Use Chemical Sterilizers.

At least 20 minutes before milking begins, the chlorine solution should be run through the machines, using half a gallon of the liquid for each unit. This is caught in the milk vat and, after rinsing the vat, is run over the milk or cream cooler. The buckets, strainer and cans for holding the market milk or cream are next rinsed, and the liquid is then retained and used for washing the udder and teats of the cows prior to milking. When using chlorine solutions for this purpose, the fluid should be changed frequently, for when it becomes dirty and contaminated it loses its germicidal properties. If the machines and utensils have been previously thoroughly cleaned with a suitable detergent, and the above routine has been carried out, using the chlorine solution at the correct strength, it may be assumed that the plant is as near sterile as is possible to get it under practical farm conditions.

The temperature of the chlorine solution is most important. One of the chief advantages of chemical sterilizers is that they are effective at ordinary temperatures. The temperature of the chlorine solution should never be greater than lukewarm. High temperatures hasten the liberation of the chlorine, especially with most hypochlorites of calcium and sodium on the market at present, and when solutions containing these preparations are heated above lukewarm the chlorine escapes so rapidly that there is a danger of its being lost before the sterilizing principle takes effect.

The Benefits of Chemical Sterilizers.

It will now be apparent that chemical sterilizers, in the form of chlorine solutions, are a valuable aid to the dairyman in his eternal fight against bacteria. They are not to be used for cleaning purposes, nor will they dispense with steam sterilization, owing to the fact that they are less penetrative than steam, but they are invaluable in destroying bacteria in previously cleansed dairy equipment. Experience has shown that, where chlorine solutions are properly employed, better quality milk and cream is possible, justifying their use in the dairy.

TUBERCULOSIS-FREE CATTLE HERDS

(AS AT 1st OCTOBER, 1949).

Breed.	Owner's Name and Address of Stud.
Aberdeen Angus	The Scottish Australian Company Ltd., Texas Station, Texas.

Queensland Butter Production, 1948-49.

Compiled by the Division of Dairying.

THE output of Queensland butter factories for the year ended 30th June, 1949, was 105,720,540 lb. The good seasonal conditions which prevailed throughout the previous year continued well into this year and production exceeded that of 1947-1948 by 1,662,856 lb.

Fluctuations in production since the record year of 1938-1939 are shown in the following table:—

Year.	Tons.
1938-39	68,919
1939-40	62,308
1940-41	52,268
1941-42	42,712
1942-43	49,782
1943-44	45,275
1944-45	42,413
1945-46	45,197
1946-47	33,304
1947-48	46,454
1948-49	47,197

Prices.

Consequent upon the arrangement whereby dairymen were to receive a price based on estimated costs of production, a further survey of costs was made in the early part of 1948. As a result, the net price return to factories was raised to a figure which would permit a price of 2s. 2d. per lb. commercial butter being paid in the year under review. This represented an increase of 2d. per pound on the figure set for the previous year and it was financed by increased home consumption and United Kingdom contract prices as well as by the continuance of Government subsidy.

The average pay-out to butter factory suppliers in recent years has been as follows:—

Year.	Commercial Butter. per lb. *s.*	*d.*
1938-39	1	1.55
1939-40	1	2.02
1940-41	1	1.88
1941-42	1	1.63
1942-43	1	3.9
1943-44	1	6.8
1944-45	1	7.9
1945-46	1	7.9
1946-47	1	8.29
1947-48	2	1.34
1948-49 (estimated)	2	2.5

Gradings.

Of the total butter production, 86.2 per cent. was officially examined by Commonwealth and State grading staffs.

Grading results were:—

	Boxes.	Per cent.
Choice grade	688,149	42.27
First grade	832,980	51.16
Second grade	95,934	5.89
Pastry grade	11,109	.68

Butter quality has shown a considerable decline in comparison with the previous year, a contributing factor being the serious degrading due to weed taint in the winter and spring months.

The accompanying tables cover the operations of individual factories for the year. The figures for make and pay are compiled from the monthly returns which each factory is required to furnish to the Department of Agriculture and Stock under the Dairy Produce Acts, and the total quantity of butter and the quantity of each grade made by each factory are shown. The pay figures show the total quantity of butter and the quantity of each grade for which suppliers have been paid.

An examination of the two sets of figures will show whether the quantity of butter manufactured in each grade can be reconciled with the quantity paid for. While some improvement has been noted in this connection it appears that some factories are still showing a tendency towards paying higher rates for cream than the grade justifies. It is difficult to understand the outlook of the manager or director who is prepared to build up his factory's output by accepting inferior cream and paying choice rates for it. Suppliers who feel inclined to accept offers of this nature should reflect that such apparent generosity can only be at the expense of their fellow dairymen or themselves. After all, second grade cream will make only second grade butter and second grade butter brings only second grade prices.

The official gradings show what has happened when the factory gradings have been checked by the Commonwealth and State graders. These official gradings are a check on the accuracy of factory gradings, though it is possible for inefficient pasteurisation or manufacture, as well as some weed taints which cannot be detected in cream when cold, to cause apparently choice butter to be degraded. It has to be remembered, too, that in many cases portion of a factory's manufacture is sold on the local market and is not subject to official grading. The percentage of output graded is shown and this should be borne in mind when comparisons are being made.

Summary of Production and Gradings.

MANUFACTURE IN LB.

Total.	Choice.	First.	Second.	Pastry.
105,720,540	62,886,638	38,407,804	4,407,282	18,816

PAY IN LB.

Total.	Choice.	First.	Second.	Pastry.
105,545,922	64,218,909	37,519,444	3,807,347	222

OVERRUN.

Actual	3.07 per cent.
Paid	3.1 per cent.

PRODUCTION, PAYMENTS, AND GRADINGS OF BUTTER IN QUEENSLAND, FOR THE YEAR ENDED 30TH JUNE, 1949.

Factory.		Manufacture and Payments in Lb.					Over-run.		Make Graded.
		Total.	Choice.	First.	Second.	Pastry.	Actual.	Paid.	Per Cent.
Atherton	Make	2,146,421	2,146,421	..	..	..	70,713	72,814	52·05
	Pay	2,148,522	2,134,433	..	14,089	..	3·41%	3·51%	..
Caboolture	Make	2,015,022	1,816,687	198,335	..	.	68,253	69,461	72·73
	Pay	2,016,230	1,874,276	139,051	2,903	..	3·51%	3·57%	..
Eumundi	Make	1,928,865	1,707,804	221,061	..	.	74,541	75,170	89·44
	Pay	1,929,494	1,745,935	183,522	37	.	4·02%	4·05%	..
Pomona	Make	1,479,832	1,423.378	56,454	..	..	37,875	38,415	92·6
	Pay	1,482,372	1,455,559	24,482	331	..	2·63%	2·66%	..
Chinchilla	Make	2,042,156	895,556	932,176	214,424	..	32,542	33,050	95·51
	Pay	2.042,664	950,438	934,843	157,383	.	1·62%	1·64%	..
Daintree	Make	82,654	82,654	..	..	..	2,184	2,184	..
	Pay	82,654	82,654	..	..	.	2·71%	2·71%	..
Dayboro'	Make	232,407	..	232,407	..	..	..	..	35·97
	Pay*	..	..	..	..	.	..	..	..
Toowoomba	Make	2,876,234	1,773,762	874,272	228,200	..	78,597	78,313	67·15
	Pay	2,875,950	1,721,015	928.343	226,592	..	2·81%	2·80%	..
Clifton	Make	1,161,552	760,872	393,064	7,616	..	37,453	37,465	92·65
	Pay	1,161,564	759,890	391.710	7,964	..	3·33%	3·33%	..
Crow's Nest	Make	1,552,936	764,960	756,952	31,024	..	40,470	40,503	97·48
	Pay	1,552,969	775,555	747,506	29,908	..	2·68%	2·68%	..

* Data Incomplete.

OFFICAL GRADINGS IN BOXES.

Factory.	Boxes Submitted As Choice.	Official Grading Result.				Boxes Submitted As First Quality.	Official Grading Result.			Boxes Submitted As Second Quality.	Official Grading Result		Boxes Submitted as Pastry Quality.
		Choice.	First.	Second.	Pastry.		First.	Second.	Pastry.		Second.	Pastry.	
Atherton ..	19,949	18,573 93·1%	1,322 6·63%	54 ·27%	..	.	..	.	..	..	..	..	..
Caboolture ..	22,447	16,585 73·89%	5,810 25·88%	52 ·23%	..	3,724	3,301 88·64%	423 11·36%	..	..	..	..	..
Eumundi ..	26,868	4,205 15·65%	22,617 84·18%	46 ·17%	..	3,939	2,525 64·1%	1,414 35·9%	..	..	..	..	..
Pomona ..	23,376	16,824 71·97%	6,552 28·03%	..	..	1,094	671 61·33%	423 38·67%	..	..	..	..	..
Chinchilla ..	14,534	6,187 42·57%	7,756 53·36%	591 4·07%	..	16,354	14,932 91·3%	1,422 8·7%	..	3,593	2,813 78·29%	780 21·71%	348
Daintree ..	..	..	..	..	.	.	..	.	..	..	..	..	..
Dayboro' ..	67	..	67 100%	..	..	1,426	1,183 82·96%	243 17·04%	..	..	..	..	..
Toowoomba .	15,021	14,315 95·3%	706 4·7%	..	.	16,171	15,731 97·28%	440 2·72%	..	3,299	3,059 92·73%	240 7·27%	..
Clifton	12,107	11,816 97·6%	291 2·4%	..		6,974	6,814 97·71%	160 2·29%	..	136	84 61·76%	52 38·24%	..
Crow's Nest ..	13,119	10,945 83·43%	2,174 16·57%	.		13,427	13,341 99·36%	86 ·64%	..	486	472 97·12%	14 2·88%	..

PRODUCTION, PAYMENTS, AND GRADINGS OF BUTTER IN QUEENSLAND, FOR THE YEAR ENDED 30TH JUNE, 1949—*continued.*

Factory.		Manufacture and Payments in Lb					Over-run.		Make Graded.
		Total.	Choice.	First	Second.	Pastry	Actual.	Paid.	Per Cent.
Dalby	Make	2,852,472	835,128	1,955,800	61,544	..	82,372	82,452	92·59
	Pay	2,852,552	816,880	1,991,813	43,859	..	2·97%	2·98%	..
Goombungee	Make	1,793,680	804,776	987,448	1,456	..	47,510	47,511	100
	Pay	1,793,681	807,437	984,760	1,484	..	2·72%	2 72%	..
Jandowae	Make	2,108,902	894,710	1,066,016	148,176	..	61,526	61,466	97·81
	Pay	2,108,842	894,543	1,066,055	148,244	..	3·01%	3·00%	..
Miles	Make	1,169,105	133,993	875,224	159,888	.	31,174	31,167	90·58
	Pay	1,169,098	134,066	874,125	160,907	..	2·74%	2·74%	..
Esk	Make	2,323,277	1,342,297	935,256	45,724	.	71,389	71,444	96·3
	Pay	2,323,332	1,337,330	948,874	37,128	.	3·17%	3·17%	..
Evelyn Tableland ..	Make	457,566	457,566	..	..	..	18,126	17,994	40·88
	Pay	457,434	452,253	4,395	786	..	4·12%	4·09%	..
Gayndah	Make	1,641,690	981,226	574,000	86,464	..	55,337	55,446	99·67
	Pay	1,641,799	971,337	588,732	81,730	..	3·49%	3·50%	..
Killarney	Make	1,542,496	706,360	712,488	123,648	..	36,996	36,864	79·82
	Pay	1,542,364	753,035	688,656	100,673	..	2·46%	2·45%	..
Logan and Albert ..	Make	3,073,761	2,394,873	623,504	55,384	..	102,600	102,401	95·99
	Pay	3,097,519	2,474,975	579,003	43,541	.	3·43%	3·42%	..
Maleny	Make	2,372,616	2,298,080	74,536	..	..	69,191	69,129	93·37
	Pay	2,372,554	2,304,130	67,944	480	..	3·00%	3·00%	..

OFFICIAL GRADINGS IN BOXES—*continued*.

Factory.	Boxes Submitted As Choice.	Official Grading Result.				Boxes Submitted As First Quality.	Official Grading Result.			Boxes Submitted As Second Quality.	Official Grading Result.		Boxes Submitted as Pastry Quality.
		Choice.	First.	Second.	Pastry		First.	Second	Pas'ry.		Second.	Pastry.	
Dalby	11,039	10,455 94·71%	584 5·29%	..	..	35,009	34,775 99·33%	234 ·67%	..	1,077	932 86·54%	145 13·46%	39
Goombungee ..	14,455	13,128 90·82%	1,327 9·18%	..	..	17,548	17.432 99·34%	116 ·66%	..	29	29 100%	..	..
Jandowae ..	15,209	14,575 95·83%	634 4·17%	..	..	18,965	18,769 98·97%	196 1·03%	..	2,662	2,451 92·07%	211 7·93%	..
Miles	957	627 65·52%	330 34·48%	..	..	15,205	11,782 77·49%	3,423 22·51%	..	2,749	1,393 50·67%	1,356 49·33%	..
Esk	22,016	16,530 75·08%	5,486 24·92%	..	..	17,169	16,908 98·48%	261 1·52%	..	766	651 84·99%	115 15·01%	
Evelyn Tableland	2,354	2,253 95·71%	101 4·29%	..	..	977	977 100%	..	..	9	9 100%	..	..
Gayndah ..	16,920	11,222 66·32%	5,528 32·67%	170 1%	..	10,743	8,742 81·37%	1,964 18·28%	37 ·35%	1,556	1,197 76·93%	359 23·07%	..
Killarney ..	7.184	5,706 79·43%	1,478 20·57%	..	..	12.666	12.417 98·03%	249 1·97%		2,137	2,101 98·32%	36 1·68%	..
Logan and Albert	40,703	12,157 29·87%	28,447 69·89%	99 ·24%	..	11,008	9,516 86·45%	1,492 13·55%	..	978	965 98·67%	13 1·33%	..
Maleny ..	38,207	34,238 89·61%	3,969 10·39%	..	..	1,331	1.119 84·07%	212 15·93%	..	23	23 100%	..	..

PRODUCTION, PAYMENTS, AND GRADINGS OF BUTTER IN QUEENSLAND, FOR THE YEAR ENDED 30TH JUNE, 1949—*continued*.

Factory		Manufacture and Payments in Lb.					Over-run.		Make Graded
		Total.	Choice.	First.	Second.	Pastry.	Actual.	Paid	Per Cent.
Maryborough	Make	851,002	505,100	332.798	13,104	..	21,684	22,388	30·47
	Pay	851,706	574,693	260.725	16,288	.	2·61%	2·70%	..
Biggenden	Make	1,868,490	894.173	974,317	..	..	77.191	77,850	95·95
	Pay	1,869,149	1,013,667	855,308	174	..	4·31%	4·35%	..
Kingaroy	Make	4,140,037	3.844.469	168,112	127,456	..	166.076	165,982	69·1
	Pay	4,139,943	3,885,817	152,344	101,782	..	4·18%	4·18%	..
Mundubbera	Make	2,958,488	2,528,520	286,272	143,696	..	101,979	101,780	97·61
	Pay	2,958,289	2,575,135	268,308	114.846	..	3·57%	3·57%	..
Wondai	Make	2,697,194	1,837.184	798,672	61,338	..	90,073	89,671	97·12
	Pay	2,696,792	1,929.499	719,962	47.331	..	3·45%	3·44%	..
Millaa Millaa	Make	878,772	878.772	..	.	..	18,073	14,387	36·63
	Pay	875,086	825,086	48,199	1,282	..	2·1 %	1·67%	..
Millmerran	Make	1,169,132	287,972	563,976	303,072	14,112	30,032	29,693	96·44
	Pay	1,168,793	323.377	584,660	260,756	..	2·64%	2·61%	..
Nanango	Make	2,856,947	1,573.427	1,249,696	33,824	..	84,894	84,782	98·6
	Pay	2,856,835	1.814,797	1,019,937	22.101	..	3·06%	3·06%	..
Oakey	Make	4,151,155	2,399.027	1,375,248	376,880	..	136,756	137,010	94·96
	Pay	4,151,409	2,423.114	1,428.589	299,706	..	3·41%	3·41%	..
Bundaberg	Make	1,952,800	594,138	1,358,662	..	..	58,859	59,684	74·1
	Pay	1,953,625	566,621	1,383.080	3,863	61	3·11%	3·15%	..

OFFICIAL GRADINGS IN BOXES—*continued.*

Factory.	Boxes Submitted As Choice.	Official Grading Result				Boxes Submitted As First Quality.	Official Grading Result.			Boxes Submitted As Second Quality.	Official Grading Result.		Boxes Submitted as Pastry Quality.
		Choice.	First.	Second.	Pastry.		First	Second.	Pastry.		Second.	Pastry.	
Maryborough ..	1,805	523 28·97%	1,262 69·92%	20 ·11%	..	2,632	2,293 87·12%	339 12·88%	..	193	38 19·69%	155 80·31%	..
Biggenden ..	15,751	9,534 60·53%	6,108 38·78%	77 ·49%	32 ·20%	16,264	15,430 94 87%	834 5·13%	.	..	..	..	..
Kingaroy ..	45,911	42,752 93·12%	3,159 6·88%	..	..	2,897	2,801 96·69%	96 3·31%		2,280	2,031 89·08%	780 10·92%	..
Mundubbera ..	43,913	16,675 37·97%	27,112 61·74%	126 ·29%	.	5,077	2,150 42·35%	2,927 57·65%	.	2,580	1,216 47·13%	1,364 52·87%	..
Wondai ..	31,373	27,135 86·49%	4,210 13·42%	28 ·09%		14,320	13,886 96·97%	434 3 03%		1,085	825 76 04%	260 23·96%	..
Millaa Millaa ..	1,704	1,668 97·89%	36 2·11%	..	..	4,044	4,044 100%		.	.	..	.	..
Millmerran ..	4,081	1,954 47·88%	2,127 52·12%	..	.	10,311	9,687 93·95%	624 6·05%		5,491	4,459 81·21%	1,032 18·79%	252
Nanango ..	27,427	19,907 72·58%	7,520 27·42%	.		22,301	20,640 92·55%	1,631 7 31%	30 ·14%	575	487 84·7%	88 15·30%	..
Oakey	38,735	36,212 93·49%	2,523 6·51%		..	24,946	24,143 96·78%	803 3·22%	..	6,713	6,687 99·61%	26 ·39%	..
Bundaberg ..	2,383	2,299 96·48%	84 3·52%	..	..	23,458	23,346 99·52%	112 ·48%	..	..	..	..	.

PRODUCTION, PAYMENTS, AND GRADINGS OF BUTTER IN QUEENSLAND, FOR THE YEAR ENDED 30TH JUNE, 1949—*continued.*

Factory.		Total.	Manufacture and Payments in Lb.				Over-run.		Make Graded.
			Choice.	First.	Second.	Pastry.	Actual.	Paid.	Per Cent.
Gladstone	Make	1,433,882	337,917	1,070,478	25,487	..	28,974	30,600	38·51
	Pay	1,435,508	381,475	1,031,471	22,562	..	2·06%	2·18%	..
Mackay	Make	639,529	228,087	411,442	..	..	15,852	17,242	..
	Pay	640,919	226,640	414,279	..	..	2·54%	2·76%	..
Monto	Make	3,916,623	2,342,091	1,524,208	45,900	4,424	86,341	86,320	93·60
	Pay	3,916,602	1,870,197	2,001,438	44,967	..	2·25%	2·25%	..
Rockhampton	Make	1,526,354	227,021	1,222,290	77,043	..	29,447	32,011	29·21
	Pay	1,527,918	232,987	1,222,117	73,814	..	1·97%	2·14%	..
Wowan	Make	2,349,168	1,160,753	1,139,469	48,946	..	33,402	52,534	92·42
	Pay	2,368,300	1,174,577	1,152,629	41,094	..	1·44%	2·27%	..
Biloela	Make	3,861,891	1,494,279	2,354,155	13,457	..	83,757	83,758	88·46
	Pay	3,861,892	1,459.528	2,390,232	12,132	..	2·22%	2·22%	..
Q.A.H.S. and College, Lawes	Make	68,519	51,551	9,968	7,000	..	972	966	25·42
	Pay	68,513	59,760	6,122	2,631	..	1·44%	1·44%	..
Boonah	Make	3,771,859	884,929	2,473,586	413,288	56	138,297	138,344	97·15
	Pay	3,771,906	960,077	2,482,664	329,165	..	3·81%	3·81%	..
Booval	Make	3,174,313	1,122,461	1,597,232	454,396	224	94,682	96,451	72·39
	Pay	3,176,082	1,186,124	1,583,136	406,822	..	3·07%	3·13%	..
Grantham	Make	2,330,902	505,238	1,735,672	89,992	..	66,521	66,541	95·44
	Pay	2,330,922	522,664	1,725,943	82,315	..	2·94%	2·94%	..

OFFICIAL GRADINGS IN BOXES—*continued.*

Factory.	Boxes Submitted As Choice.	Official Grading Result. Choice.	First.	Second.	Pastry.	Boxes Submitted As First Qualilry.	Official Grading Result. First.	Second.	Pastry.	Boxes Submitted As Second Quallity.	Official Grading Result. Second.	Pastry.	Boxes Submitted as Pastry Quallitry.
Gladstone ..	2,703	2,625 97·11%	78 2·89%	..	..	18,399	18,146 98·62%	253 1·38%	..	282	282 100%	..	..
Mackay ..	..	..	..	..	..	..	..	..	..	..	..	..	..
Monto	37,193	34,699 93·29%	2,494 6·71%	..	..	28,467	27,375 99·67%	92 ·33%	..	728	470 64·56%	258 35·44%	79
Rockhampton ..	..	..	..	..	..	6,581	5.888 89·47%	693 10·53%	..	1,382	622 45·01%	760 54·99%	..
Wowan ..	18,775	15,676 83·50%	3,061 16·30%	38 ·20%	..	19.236	18,365 95·47%	871 4·53%	..	758	373 49 21%	385 50·79%	..
Biloela	22,961	19,870 86·54%	3,091 13·46%	..	..	37,778	37.203 98·48%	575 1·52%	..	267	267 100%	..	..
Lawes	8	..	8 100%	..	..	178	130 73·03%	48 26·97%	..	125	125 100%	..	..
Boonah.. ..	13,994	5,321 38·02%	8,673 61·98%	..	..	44,284	43,858 99·04%	426 ·96%	..	7,158	6,900 96·4%	258 3·6%	..
Booval	5,086	2,862 56·27%	2,066 40·62%	76 1·50%	82 1·61%	28,150	28,029 99·57%	121 ·43%	..	7,798	7,652 98·13%	146 1·87%	..
Grantham ..	7,121	3,251 45·65%	3,870 54·35%	..	..	30,950	30,609 98·9%	341 1·10%	..	1,655	1,440 87·01%	215 12·99%	..

PRODUCTION, PAYMENTS, AND GRADINGS OF BUTTER IN QUEENSLAND, FOR THE YEAR ENDED 30TH JUNE, 1949—*continued.*

Factory.		Manufacture and Payments in Lb					Over-run		Make Graded.
		Total.	Choice.	First.	Second.	Pastry.	Actual.	Paid.	Per Cent
Laidley	Make	1,817,304	829,194	910,328	77,782	..	63,631	63,628	95·15
	Pay	1,817,301	874,776	872,581	69,994		3·63%	3·63%	..
Lowood	Make	884,031	230,026	630,782	23,223		19,605	19,612	94·78
	Pay	884,032	235,581	630,669	17,779		2·27%	2·27%	..
Roma	Make	1,098,533	..	630,373	468,160	..	33,125	33,125	61·81
	Pay	1,098,533	146,890	536,805	414,677	161	3·11%	3·11%	..
Murgon	Make	2,678,255	1,602,113	1,055,590	20,552	..	87,706	87,970	81·91
	Pay	2,678,519	1,973,760	692,383	12,376	..	3·39%	3·40%	..
Proston	Make	1,509,627	980,147	479,136	50,344	..	46,918	46,442	98·73
	Pay	1,509,151	1,038,145	429,453	41,553	..	3·21%	3·18%	..
Kingston	Make	3,708,936	2,069,984	1,451,240	187,712	..	118,132	118,051	97·55
	Pay	3,708,855	1,145,544	1,392,879	170,432		3·29%	3·29%	..
Woodford	Make	1,232,866	947,434	277,872	7,560	..	41,143	46,740	94·2
	Pay	1,238,463	1,081,702	153,186	3,575	..	3·45%	3·92%	..
Allora	Make	1,416,050	1,403,797	11,301	952	..	36,632	36,478	90·63
	Pay	1,415,896	1,394,522	20,067	1,307	..	2·66%	2·64%	..
Inglewood	Make	405,776	181,832	196,392	27,552	..	10,308	9,612	78·28
	Pay	405,080	145,867	232,999	26,214		2·61%	2·43%	..
Mill Hill	Make	1,424,457	1,402,001	..	22,456	..	49,439	50,720	61·97
	Pay	1,425,738	1,267,676	144,515	13,547	..	3·60%	3·69%	..

OFFICIAL GRADINGS IN BOXES—*continued*.

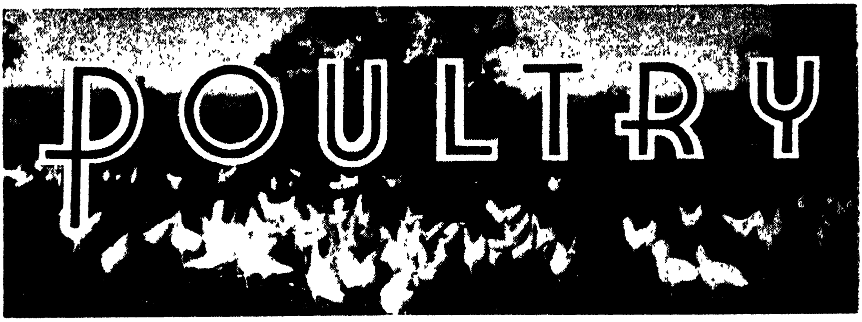
Factory.	Boxes Submitted As Choice.	Official Grading Result				Boxes Submitted As First Quality.	Official Grading Result.			Boxes Submitted As Second Quality.	Official Grading Result.		Boxes Submitted as Pastry Quality.
		Choice.	First.	Second.	Pastry.		First.	Second.	Pastry.		Second.	Pastry.	
Laidley ..	13,360	7,030 52·62%	6,289 47·07%	41 ·31%	..	16,136	15,852 98·24%	284 1·76%	..	1,382	1,061 76·77%	321 23·23%	..
Lowood ..	3,288	2,075 63·11%	1,213 36·89%	.	.	11,268	11,127 98·75%	141 1·25%	..	407	257 63·14%	150 36·86%	..
Roma	..	..	..	..	..	3,811	3,637 95·43%	145 3·81%	29 ·76%	8,314	8,064 96·99%	250 3·01%	..
Murgon.. ..	20,062	13,984 69·70%	6,020 30·01%	58 ·29%	..	18,761	18,553 98·89%	208 1·11%	..	348	226 64·94%	122 35·06%	..
Proston ..	17,132	8,124 47·42%	9,008 52·58%	..	.	8,651	8,369 96·74%	282 3·26%	..	831	822 98·92%	9 1·08%	..
Kingston ..	36,060	35,119 97·39%	941 2·61%		.	25,251	25,251 100%	..	..	3,289	3,289 100%	..	..
Woodford ..	15,180	11,981 78·93%	3,199 21·07%	.	..	5,458	5,114 93·7%	344 6·30%	..	100	100 100%	..	..
Allora	22,675	21,677 95·60%	998 4·4%	..	..	225	225 100%	..	..	17	17 100%	..	..
Inglewood ..	1,783	1,359 76·22%	424 23·78%	..	.	3,361	3,016 89·74%	345 10·26%	..	528	446 84·47%	82 15·53%	..
Mill Hill ..	15,373	14,062 91·47%	1,285 8·36%	26 ·17%	..	..	..	..	..	382	345 90·31%	37 9·69%	8

OFFICIAL GRADINGS IN BOXES—*continued.*

Factory.	Boxes Submitted As Choice.	Official Grading Result.				Boxes Submitted As First Quality.	Official Grading Result.			Boxes Submitted As Second Quality.	Official Grading Result.		Boxes Submitted as Pastry Quality.
		Choice.	First.	Second.	Pastry.		First.	Second.	Pastry.		Second.	Pastry.	
Texas	..	..	..	..	..	273	242 88·63%	31 11·36%	..	95	84 88·42%	11 11·58%	..
Cooroy	16,742	11,439 68·33%	5,280 31·54%	23 ·13%	..	3,530	2,976 84·31%	554 15·69%	..	132	121 91·67%	11 8·33%	..
Gympie ..	104,385	97,995 93·88%	6,390 6·12%	..	..	7,786	5,952 76·44%	1,834 23·56%	..	2,041	1,378 67·52%	663 32·48%	..

PRODUCTION, PAYMENTS, AND GRADINGS OF BUTTER IN QUEENSLAND, FOR THE YEAR ENDED 30TH JUNE, 1949—*continued*.

Factory.		Manufacture and Payments in Lb.					Over-run.		Make Graded.
		Total.	Choice.	First.	Second.	Pastry.	Actual.	Paid.	Per Cent.
Texas	Make	153,105	131,769	16,072	5,264	..	6,705	7,108	13·46
	Pay	153,508	41,682	103,305	8,521	..	4·58%	4·86%	..
Cooroy	Make	1,231,676	1,035,956	188,944	6,776	..	37,150	37,421	92·77
	Pay	1,231,947	1,149,501	82,423	23	..	3·11%	3·11%	..
Gympie	Make	6,709,223	6,154,173	444,528	110,522	..	207,065	206,582	95·32
	Pay	6,708,740	6,271,065	351,522	86,153	..	3·18%	3·18%	..



Breeds of Fowls.

P. RUMBALL, Officer in Charge, Poultry Branch.

ORIGIN OF THE DOMESTIC FOWL.

A VISIT to the poultry pavilion at any Show reveals a great number of breeds, with all their variety of type and colour, yet the many breeds exhibited at the State's largest Show represent only a small percentage of the recognised breeds of the world.

To the best of our knowledge all breeds of fowls had a common ancestor, which Darwin suggested was a species of wild jungle fowl (*Gallus bankiva*), an inhabitant of Assam, Burma, Siam and adjacent countries. Records indicate that the fowl was common in China in 1400 B.C., but it was not introduced into Australia until 1788.

How the distinctive characters of various breeds originated in early times is a matter for conjecture. There is no doubt that the evolution of the early breeds was due to the influence of natural selection, in which environment played a major part, and those unaccountable mutations or "sports" of which every poultry-breeder is aware.

With domestication, natural selection gave way to man-controlled or "artificial" selection. By retaining only those birds which showed characters that appealed to his fancy he took over Nature's work and shortened tremendously the period of time required for the creation of a new breed. Only in comparatively recent times did man realise that he possessed the power to create new breeds from existing ones and by careful breeding and selection to improve the existing ones as well. To attempt to explain in detail how all present-day breeds were evolved is entirely beyond the scope of this article, but a brief history is given when dealing with standards.

BREEDS.

It is impossible to deal with all breeds, and reference will only be made to those that are used to an appreciable extent in this State for commercial purposes.

All breeds of poultry readily adapt themselves to the climatic conditions in the coastal areas of Queensland, but, as a general principle, it can be taken that what are referred to as heavy or dual-purpose breeds and game breeds are more adversely affected by extremes of heat than those referred to as light breeds, while the light breeds appear to be more adversely affected by extremes of cold than the dual-purpose and game classes.

Extremes of heat, cold, wind and rain are not conducive to the best results with any breed, and consequently protection should be afforded all classes of poultry against these unfavourable conditions. Although dual-purpose breeds appear to be more adversely affected by heat than light breeds, it is considered that conditions of housing could be such as to permit of the successful raising of these breeds in the hottest districts of the State.

Commercial poultry may be grouped into three classes—light, heavy or dual-purpose, and game.

Light Breeds.

Light breeds are usually breeds developed extensively for egg production, with little or no attention being paid to table qualities. This class of bird may also be classed as a non-sitter. Among many strains, individuals will be found in which the broody trait has not been bred out, but taken collectively they may be classed as non-sitters. Another characteristic of the light breeds is that they are layers of white-shelled eggs.

Among this class Leghorns predominate, with probably the Ancona being the next most popular, followed by the Minorca.

Heavy or Dual-Purpose Breeds.

Breeds of this class have been developed for table and egg-producing qualities. Taken as a group they are not as efficient egg producers as the light breeds, but individuals of this class hold the record as egg producers in this State, namely 354 eggs in 365 days. Without exception, the heavy breeds are very docile, whereas light breeds are of a more or less nervous disposition. Breeds of this class may also be referred to as sitters. Every effort has been made to breed this characteristic out, and it has been done to some considerable extent by many breeders, but in the best of flocks broody hens will be found. The egg of this class should be brown in colour, although many pale eggs will be found in all breeds.

The most popular breed of this class is the Australorp. The Rhode Island Red is probably next in favour, followed by the Langshan and the Sussex.

Game Class.

This is essentially a table class, but it is not profitable to breed game fowls for this purpose. The most profitable manner in which game fowls might be utilised is for crossing purposes. The crossing of the game male with utility females brings about a marked improvement in the quality of breast meat.

Among the game class are Old English, Indian, and Australian game.

LOCATION AND NAMES OF EXTERNAL PARTS OF THE FOWL.

(With an explanation of parts and faults of the commercial breeds of Queensland. See Plate 107 for details.)

ABDOMEN.—The rear portion of the body; that portion not protected by a bony structure.

Faults.—Sagging, hard, due to excessive fat or internal disorders; distended with fluid.

BACK.—The top of the body from the neck to the base of the tail. It should be long, but varies according to the breed. It should also be wide and flat.

Faults.—Narrow; roach; or any deformity.

BEAK.—Both mandibles. The beak should be of medium length, strong, and slightly curved.

Faults.—Long; straight; short; crossed; parrot.

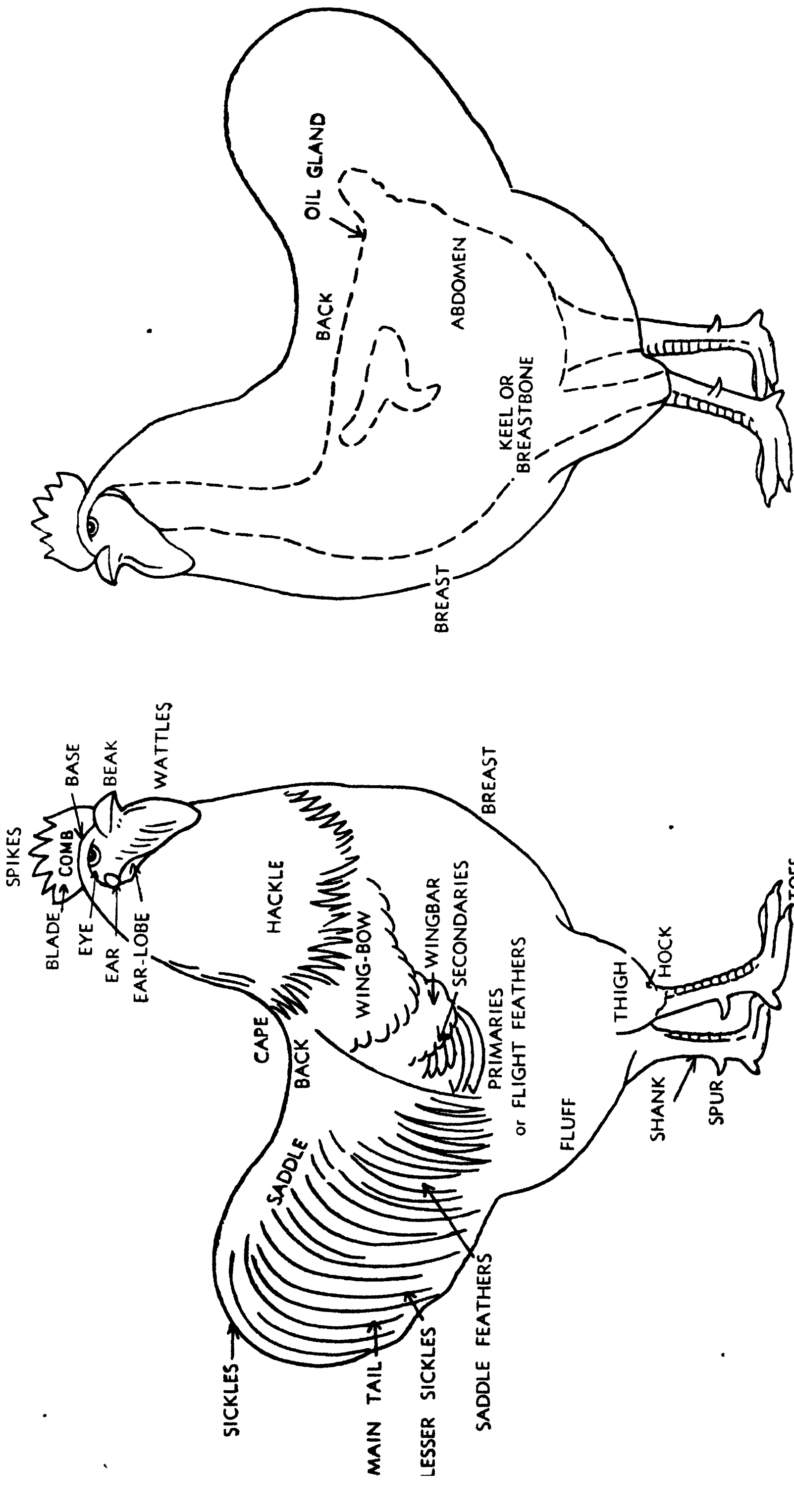


Plate 107.

PARTS OF THE FOWL.

BREAST.—From the point of the keel to the base of the neck.

Faults.—Cut away, frequently termed "lack of front"; pendulous due to the enlargement of the crop.

COMB.—A fleshy growth on top of the skull. Two types in poultry bred in this State for commercial purposes, viz., single and rose. Peacombs are found on Indian Game.

Single Comb.—Single, fleshy, serrated formation extending from the beak backward and over the head. The serrations should be deep and even, and broad between the points of the spikes. Portions of the comb are referred to as the—

Spikes—The pointed portion on the upper part of the comb.

Blade—The portion of the comb at the rear of the last spike.

Base—The portion of the comb adjoining the head.

Rosecomb.—A low, solid, fleshy mass, covered on its upper surface with small rounded points, frequently referred to as "working," terminating in a well-defined spike at the rear, known as the leader.

Faults.—Single—Lopped in males and heavy breed females; erect in light breed females, such as Leghorns; crooked; twisted; thumb marks; coarse; unevenly serrated; side sprigs.

Rosecomb.—Lopped; smooth; hollow or split centre; twisted; crooked.

EAR.—The organ of hearing, which is situated at the rear of and slightly below the eye. It is protected by a tuft of small feathers.

EAR-LOBES.—The raised skin below the ears. Should be of correct size and shape in conformity with the standard, smooth and open.

Faults.—Wrinkled; incorrect size or shape; folded; red in white lobes; white in red lobes; blistered.

EYE.—The eye should be full, round, prominent, bright, and expressive, conforming in colour to the standard of the breed.

Eyelids.—The eyelids consist of upper, lower, and a thin white nictitating membrane, which is mainly concealed.

Eye-ring.—The edges of the eyelids. In a yellow-skinned bird the yellow pigment bleaches out very rapidly from the eye-ring with production.

Faults.—Pupil misshapen; iris incorrect colour; eyes that give the appearance of being other than round; sunken eyes.

FACE.—The bare or almost featherless area between the lobes and the point of the beak. Should be free from feathers, bright red, smooth, and full.

Faults.—Excessive feathering; skin dark or white; wrinkled; sunken.

LEG.—Includes the thigh (fleshy part) and shank (scaly part).

Faults.—Bow-legged; in-kneed; malformations.

NOSTRILS.—The openings at the base of the upper mandible of the beak extending into the head.

OIL-GLAND.—Situated immediately in front of the base of the tail. Supplies oil for the bird's feathers.

SADDLE.—The rear portion of the back, extending to the tail, from which the saddle hackle or feathers grow in a male. In a female the feathers are termed the cushion.

SPUR.—The horn-like growth on the shanks of the males. A fault in females.

TOES.—There are four toes, three projecting forward and one backward. The toes should be straight, and in length proportionate to the bird.

Faults.—Crooked; enlarged joints.

WATTLES.—The pendant fleshy growths at the sides and base of the beak, conforming with the comb in size.

Faults.—Misshapen; beefy; uneven in size; any tendency to fold inwards in front.

WINGS.—The upper limbs or arms of the fowl.

Faults.—Carried unevenly or loosely, resulting in the wing being not held in proper position, termed slipwing; associated with twisted and curled flight feathers.

PLUMAGE.

CAPE.—The short feathers underneath the neck hackle coming over the shoulders, collectively shaped like a cape.

CUSHION.—The mass of feathers at the rear of the back of a hen, partly covering the tail, and corresponding to the saddle in the male.

Fault.—In most commercial breeds, looseness of cushion is a serious defect.

FLUFF.—Soft downy feathers around the thighs and the abdomen; the downy part of feathers; the small feathers between the toes of birds.

HACKLES.—The neck plumage of a fowl, or the saddle plumage of a cock, consisting of long, narrow pointed feathers.

LEG FEATHERS.—Feathers projecting from the outer side of the shanks—e.g., Langshans.

SICKLES.—The long, curved feathers of a male's tail.

TAIL.—True tail feathers are long, broad, and stiff. Tail coverts are in front of and at the side of the tail.

Faults.—In tail carriage—squirrel; low; wry.

UNDER-COLOUR.—The colour of the fluff of the feathers.

WING.—*Primaries.*—The outer flight feathers, hidden when the wing is closed.

Secondaries.—The inner flight feathers, which are on the outside when the wing is closed.

Wing-bar.—Any line of dark colour across the middle of the wing caused by the colour or marking of the feathers known as the lower wing coverts.

Wing-bay.—The triangular part of a folded wing between the wing-bar and the end of the flight feathers.

Wing-bow.—The upper or shoulder part of the wing.

Faults.—A wing so irregularly formed that it shows a decided gap between primaries and secondaries.

[TO BE CONTINUED.]

EXPORT OF POULTRY MEAT DOUBLES.

Queensland's export trade in dressed poultry more than doubled itself last year, said the Minister for Agriculture and Stock (Honourable H. H. Collins) recently.

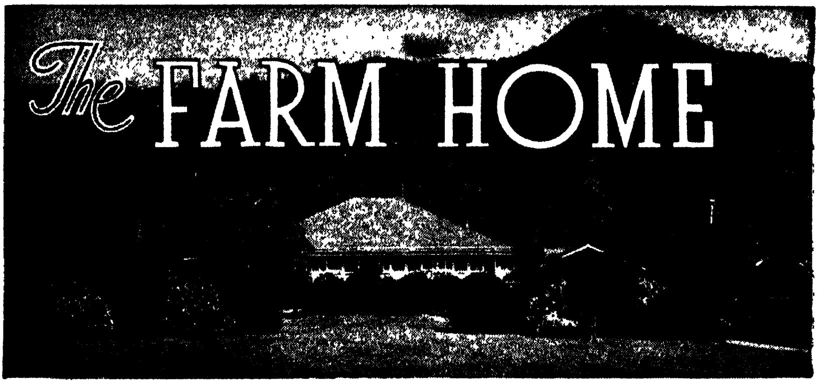
Few markets, he said, had developed so rapidly. Figures from the Poultry Branch of his Department showed that for the year ended June 30th last 3,400,320 lb. (1,518 tons) of dressed poultry of a gross value of £400,000 went overseas from Queensland, practically all to Great Britain. The previous year's figures were 1,333,527 lb. with a value of about £150,000.

Present indications were that the 1948-49 figures would be maintained, if not exceeded, in the current 12 months.

Officers of the Branch reported that the poultry exported comprised hens, young cockerels, ducks and turkeys. Before the war this export trade did not exist, and Great Britain then got most of its poultry meat requirements from European countries. The war ended this trade with Britain but gave Australia its chance of capturing the market.

However, it is expected that with the rehabilitation of Europe, Australia sooner or later would have to face competition from European countries on the British market. Therefore, the prime duty of poultry fatteners was to raise the highest quality birds for this market so that the trade can be retained.

The export trade had also aided the poultry industry in another way. Before it was developed a very large percentage of cockerel chickens was destroyed as day-old chicks, because without a paying market it was not economical to raise them. Now the market is available, these chickens are being raised for export and are giving a good return to the farmer.



Sleep and the Baby.

LIFE almost begins with sleep. It is as essential for the child's healthy development as is its mother's milk. In fact, in infancy sleep is closely related to nutrition. The baby eats to sleep and he wakes to eat, which promptly puts him again to sleep, so that the two functions almost overlap!

Sleeping Period.

Until he is a month old the average infant sleeps a total of 22 out of 24 hours. These long hours of sleep are necessary so that the nervous system may gain the opportunity to adapt itself to independent functioning. At birth the nerve sheaths are incompletely formed and some of these structures are poorly "insulated." The "insulation process" takes several months to mature. For this reason practically all infants for the first few months easily jump or startle.

As the infant grows and its nerve coverings increase in quality and amount, the periods of sleep decrease. At two months a baby usually sleeps about 20 hours out of 24. At four months he may be expected to sleep 16 to 18 hours a day, and at one year 14 to 16 hours. There are wide variations, of course, and it must be recognized that sleep is not a well defined, uniform response, but that it varies enormously with the individuality of the child and still more with its maturity. If a child sleeps less but is happy during his waking hours, one need not be concerned. If he sleeps more, but shows normal mental reactions when awake, this, too, can be passed without worry.

We must be prepared to find variations in sleep behaviour from time to time, sometimes from day to day. Such variations betray the complexity of sleep as behaviour. One is accustomed to think of sleep as a cessation of behaviour; it is, however, a positive function. It is not a mere stoppage of machinery; it is a readjustment of the whole machinery of the organism, including the central nervous system, to protect the total and remote welfare of this organism.

All sleep is, so to speak, vulnerable; how vulnerable depends upon two factors: the constitution of the child and the maturity of the child. He is especially likely to show disturbances of sleep behaviour during transitional periods of imbalance when growth changes and consequent readjustments are most actively taking place.

The young baby simply falls off to sleep; the young child walks a winding path along the precipice of wakefulness before he falls off to sleep. It is as though he had to pick his way, before he finds just the right spot for the plunge.

Wakening at Night.

There are many babies who at one year and older make it a practice to awaken in the middle of the night, crying without apparent reason. Many parents erroneously attribute this to teething. Why the teething pains abate promptly when the baby is taken into the parent's bed, as is almost invariably the case, one apparently does not stop to consider. The fact is that the awakening on the part of the child is merely an effort to obtain a little extra attention to which he is not entitled. The only way by which this bad habit may be stopped is never to give it an opoprtunity to develop. The child must be made to realize from the beginning that the comfort of others must be respected as well as his own. A good practice to follow when the baby first awakens during the night is to investigate the cause. If he is thirsty, he should be given water. If he is wet, he should be changed; and when his needs have been attended to he should be tucked in without comment and left alone. A respectable baby knows his limitations in crying. He stops only when he learns that it does not bring results.

Going to Sleep.

The mother's training of a child in sleep should be insistent and carried out with assurance. It should aim at accustoming him to settle easily in bed, in darkness, although not necessarily in complete quiet.

Some children develop elaborate pre-sleep rituals which seem to aid the process of release into sleep and which should not be unduly interfered with. For instance, the child takes one or two favourite toys to bed with him: he talks and sings to himself: he may even indulge in a brief work-out wrestle with his bedclothes. These seem to be relaxational expedients.

More extreme deviations also occur, as rocking on hands and knees, bed shaking, head banging and head rolling. However annoying they may be, it is apparent that they are but variants and exaggerations of normal methods of sleep release. Removal of the physical restraint of a sleeping bag and postponement of bed time to increase fatigue are helpful measures. If the deviation persists beyond the second year, a shift from the accustomed cot to a new bed may bring about a dramatic termination.

Sleeplessness.

Failure to settle or sleep may, however, be a symptom of various physical or nervous disorders and it may be necessary to enlist the aid of a doctor to help the mother distinguish between disturbances due to physical ailments and those due to "playing up" on the part of the child. Of simple physical causes, general health, nutrition, teething troubles, feverishness and worms and obstructed air passages are the most common. Disturbed sleep may also have an emotional or environmental basis—as change of scene, undue excitement, feelings of insecurity caused maybe by family dissension or illness, and fears due to any cause. Restless sleep, talking and nightmares are only significant if there is other evidence of illness or anxiety.

Any further information on this and other matters connected with children may be obtained by communicating personally with the Maternal and Child Welfare Information Bureau, 184 St. Paul's Terrace, Brisbane, or by addressing letters "Baby Clinic, Brisbane." These letters need not be stamped.

ASTRONOMICAL DATA FOR QUEENSLAND.

DECEMBER, 1949.

By W. J. Newell, Hon. Secretary of The Astronomical Society of Queensland.

TIMES OF SUNRISE AND SUNSET.

At Brisbane.			Minutes Later than Brisbane at Other Places.					
Day.	Rise.	Set.	Place.	Rise.	Set.	Place.	Rise.	Set.
	a.m.	p.m.						
1	4.45	6.28	Cairns	51	7	Longreach	44	26
6	4.46	6.32	Charleville ..	30	24	Quilpie	33	37
11	4.47	6.36	Cloncurry	65	34	Rockhampton ..	19	1
16	4.49	6.38	Cunnamulla ..	27	32	Roma	19	15
21	4.51	6.41	Dirranbandi ..	16	22	Townsville ..	42	8
26	4.54	6.43	Emerald	28	11	Winton	52	29
31	4.56	6.46	Hughenden ..	49	21	Warwick	2	6

TIMES OF MOONRISE AND MOONSET.

At Brisbane.

Day.	Rise.	Set.
	p.m.	a.m.
1	2.39	1.50
2	3.32	2.18
3	4.27	2.47
4	5.23	3.20
5	6.21	3.58
6	7.20	4.42
7	8.16	5.32
8	9.08	6.28
9	9.55	7.29
10	10.36	8.31
11	11.13	9.34
12	11.47	10.37
13	..	11.38
	a.m.	p.m.
14	12.20	12.41
15	12.53	1.45
16	1.28	2.51
17	2.06	4·00
18	2.51	5.11
19	3.42	6.20
20	4.40	7.25
21	5.44	8.22
22	6.50	9.10
23	7.54	9.51
24	8.55	10.26
25	9.53	10.56
26	10.47	11.24
27	11.39	11.51
	p.m.	a.m.
28	12.31	..
29	1.23	12·18
30	2.17	12.47
31	3.13	1.18

MINUTES LATER THAN BRISBANE (SOUTHERN DISTRICTS).

Charleville 27; Cunnamulla 29; Dirranbandi 19;
Quilpie 35; Roma 17; Warwick 4.

MINUTES LATER THAN BRISBANE (CENTRAL DISTRICTS).

Day.	Emerald.		Longreach.		Rockhampton		Winton.	
	Rise.	Set.	Rise.	Set.	Rise.	Set.	Rise.	Set.
1	16	21	31	37	7	12	36	43
6	9	30	25	45	0	21	26	53
11	14	26	29	42	4	17	33	49
16	23	14	39	29	14	4	45	33
21	30	9	46	23	21	0	54	26
26	21	18	38	34	12	9	43	38
31	12	26	27	42	2	18	30	50

MINUTES LATER THAN BRISBANE (NORTHERN DISTRICTS).

Day.	Cairns.		Cloncurry.		Hughenden.		Townsville.	
	Rise.	Set.	Rise.	Set.	Rise.	Set.	Rise.	Set.
1	22	33	45	54	30	38	19	29
3	13	43	39	59	24	45	12	36
5	5	51	35	64	19	50	5	43
7	2	56	33	67	17	53	3	46
9	7	53	36	66	20	51	7	44
11	16	45	41	60	26	46	14	37
13	27	33	49	54	33	38	23	29
15	33	22	53	45	38	30	28	19
17	45	9	61	36	46	22	37	9
19	55	2	68	32	51	17	45	3
21	56	2	68	32	52	17	46	3
23	50	11	64	38	48	23	41	11
25	39	22	56	45	41	30	33	19
27	29	31	50	52	35	37	25	27
29	19	37	42	56	27	41	17	32
31	10	46	37	61	22	47	9	38

Phases of the Moon.—Full Moon, 6th December, 1.13 a.m.; Last Quarter, 13th December, 11.48 a.m.; New Moon, 20th December, 4.55 a.m.; First Quarter, 27th December, 4.31 p.m.

On 22nd December the Sun will reach its maximum angle south of the Equator and from Northern Queensland will rise and set 25 degrees south of true east and true west respectively and as viewed from Southern Queensland, 28 degrees south of true east and true west.

On 14th and 27th December the Moon will rise and set approximately at true east and true west respectively.

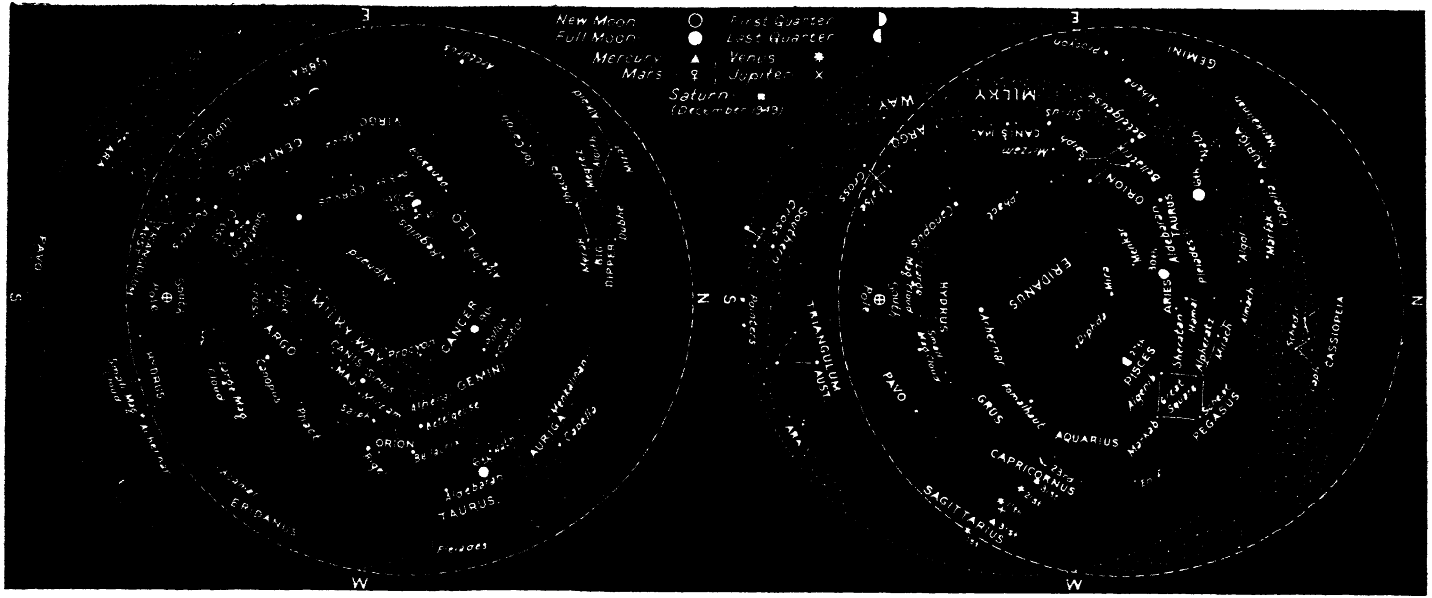
Mercury.—At the beginning of December, in the constellation of Cancer, will set 26 minutes after the Sun and will remain an evening planet all this month, setting on the 31st 1 hour and 20 minutes after the Sun.

Venus.—In the constellation of Capricornus, will set 3½ hours after the Sun at the beginning of the month and on the 7th will pass 2 degrees south of Jupiter, while on the 26th it will attain greatest brilliancy. At the end of the month it will set about 2½ hours after the Sun.

Mars.—Rising an hour or so after midnight, in the constellation of Leo, at the beginning of December. It will rise about midnight in the constellation of Virgo at the end of the month.

Jupiter.—Now fast moving out of the evening sky it will set between 10 p.m. and 11.15 p.m. at the beginning of the month but will set only 1¾ hours after the Sun at the end of the month.

Saturn.—Rising at the same time as Mars, at the beginning of the month, it will remain in Leo throughout the month and on the 31st will rise between 10.45 p.m. and midnight.



Star Charts.—The chart on the right is for 8.15 p.m. in the south-east corner of Queensland to 9.15 p.m. along the Northern Territory border on the 15th December. (For every degree of Longitude we go west, the time increases by 4 minutes.) The chart on the left is for 7 hours later. On each chart the dashed circle represents the horizon as viewed from Cape York and the dotted circle is the horizon for places along the New South Wales border. When facing north hold "N" at the bottom; when facing south hold "S" at the bottom and similarly for the other directions. Only the brightest stars are included and the more conspicuous constellations named. The stars which do not change their relation to one another, moving east to west, arrive at any selected position about 4 minutes earlier each night. Thus at the beginning of the month the stars will be in the positions shown about 1 hour later than the time stated for the 15th and at the end of the month about 1 hour earlier than that time. The positions of the Moon and planets, which are continually changing in relation to the stars are shown for certain marked days. When no date is marked the position is for the middle of the month.

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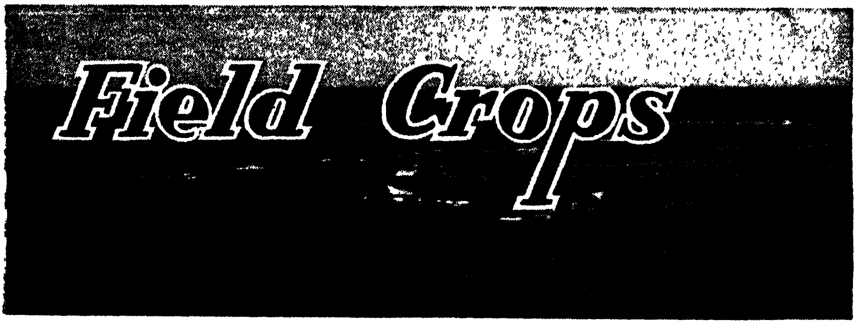


Agriculture in the Upper Burnett.

K. V. Henderson, Senior Adviser in Agriculture.

THE district defined as the Upper Burnett in this article is that portion of the Burnett River basin which is bounded by the Dawes Range on the north, the Burnett Range on the east, and the Auburn Range on the western side (see Plate 108). This area embraces a large percentage of first-class agricultural land along the creek frontages, second-class agricultural land on the lower slopes and the Mulgildie Plateau, and first- and second-class grazing country on the remainder.

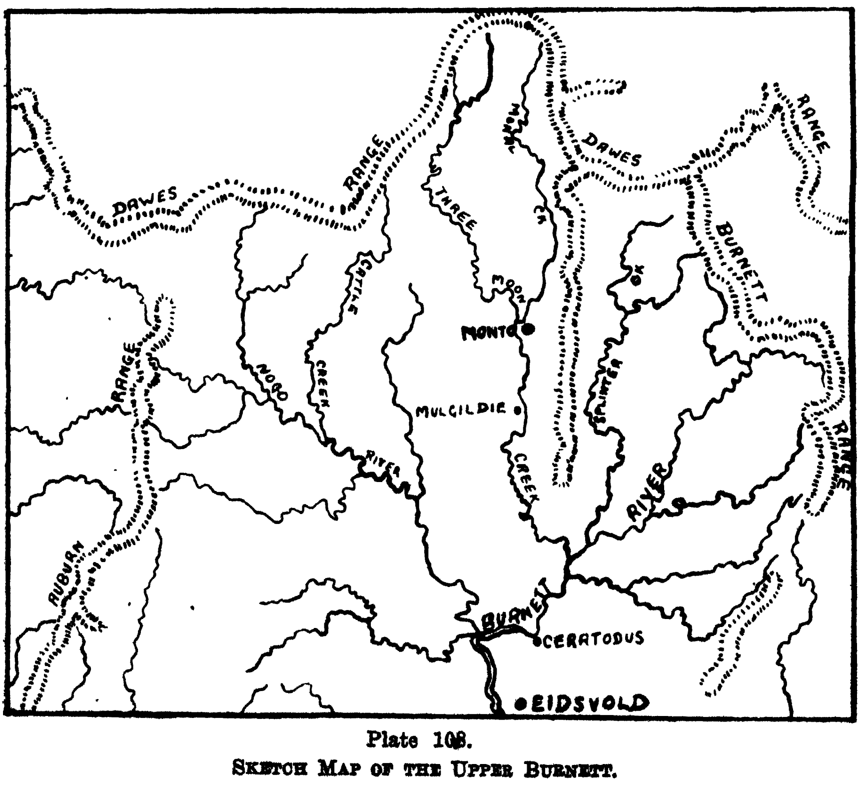


Plate 108.
Sketch Map of the Upper Burnett.

Subsequent to the passing of the Upper Burnett and Callide Valley Land Settlement Act in 1923, station holdings such as Mulgildie, Dalgangal, Cania, and Cannindah, in the Upper Burnett, were resumed and surveyed into living areas with the object of closer settlement. Demonstration areas were established in 1922 in the vicinity of the present town of Monto, the object being to grow various crops and so demonstrate to prospective settlers the productivity of the soils in the district. In all, 70 acres of scrub, forest, and alluvial soils were utilised for this purpose. Ballots for the blocks were conducted in December, 1923, and it was not long before the first pioneers arrived on their holdings to commence the development of what has now become a thriving dairying district.

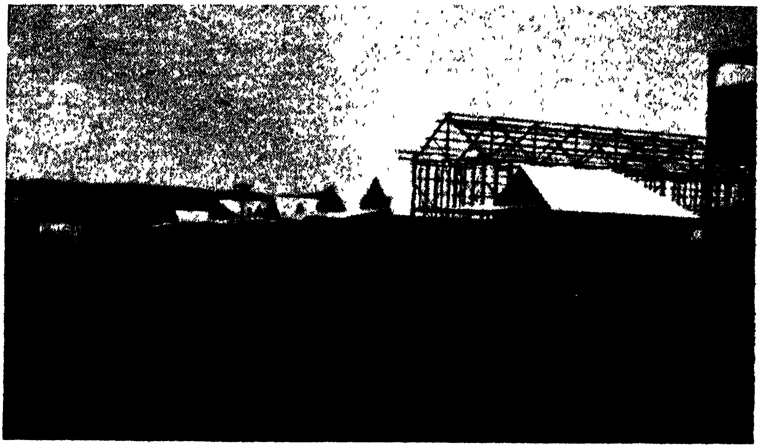


Plate 109.
THE MAIN STREET OF MONTO IN 1928.

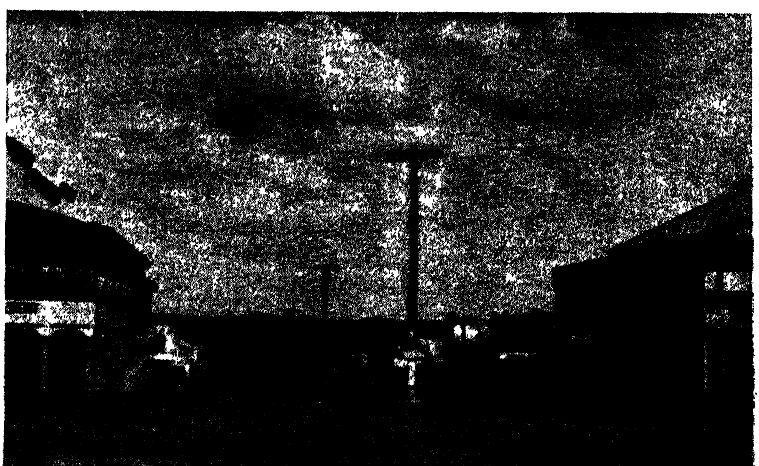


Plate 110.
THE MAIN STREET OF MONTO IN 1948.

These blocks were opened originally as Perpetual Lease Selections and Grazing Homestead Leases, but later some selections were converted into Agricultural Farms on a freehold basis. Although much of the area is cleared it is considered that there is still scope for further development on most of the farms to improve the output of primary produce from the district. Such improvement could be brought about by better cultivation practices and grassland management.

Monto (Plates 109 and 110), the principal town in the district and 767 feet above sea level, is, for its 24 years of existence, a very prosperous business centre. Railway communication is with Maryborough and Gladstone, 179 miles and 101 miles distant, respectively. Latest available figures place the population of the township of Monto at 1,869 and of the district generally at 4,500.

CLIMATE.

The Upper Burnett has a sub-tropical inland climate, summer maximum temperatures averaging over 90 deg. F., while over 106 deg. F. has been recorded during heat wave periods. In winter a ground minimum temperature as low as 17.5 deg. F. has been recorded.

Rainfall is mainly distributed over the summer months from October to March, although fair rains may be experienced during the winter months. Individual monthly totals for Monto are shown in Table 1 for the period 1937 to 1948, inclusive.

TABLE 1.

RAINFALL (IN POINTS) AT MONTO, 1937-1948.

Year.	Jan.	Feb.	Mar.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Yearly Total.
1937	86	547	568	36	55	103	174	143	4	248	348	417	2,729
1938	555	16	880	127	579	187	215	180	4	306	648	174	3,771
1939	603	390	949	381	51	274	269	56	25	149	105	668	3,920
1940	243	507	636	96	58	22	70	96	67	23	252	302	2,372
1941	307	124	323	92	310	262	7	52	26	192	194	193	2,082
1942	815	1,602	98	182	178	84	147	38	34	105	88	682	4,053
1943	292	484	37	188	253	193	Nil	121	Nil	732	162	410	2,983
1944	403	375	128	77	261	89	227	101	29	25	461	147	2,323
1945	487	714	120	229	114	187	275	Nil	132	235	141	253	2,887
1946	272	47	217	44	Nil	2	24	12	75	232	257	105	1,227
1947	206	1,042	499	78	74	2	15	195	347	192	506	321	3,477
1948	237	467	351	220	408	286	275	Nil	120	Nil	309	258	2,931
Av. 12 year period	375	526	400	146	195	141	142	83	81	203	289	327	2,896

SOILS AND VEGETATION.

The soils can be broadly classified into four main groups, each of which carries a distinctive vegetation association. These groups are—(1) alluvial soils, (2) the soils of the lower slopes, (3) the brigalow scrub soils, and (4) the softwood scrub soils.

Alluvial Soils.

These soils carry a forest vegetation of which the main constituent is blue gum (*Eucalyptus tereticornis*). Spotted gum (*E. maculata*), mahogany or apple tree (*Angophora* sp.), and Moreton Bay ash (*Eucalyptus tesselaris*) are also found.

Plate 111.
LUCERNE PADDOCK ON MONAL CREEK.

Plate 112.
CULTIVATION LAND ON THE MONAL CREEK ALLUVIAL.—This is the site of the Monal Creek Exploratory Farm which was operated in the early days of closer settlement in the area.

Plate 113.
CATTLE PUMPKINS ON AN ALLUVIAL FARM.—This property is close to the junction of Three Moon and Splinter Creeks with the Burnett River.

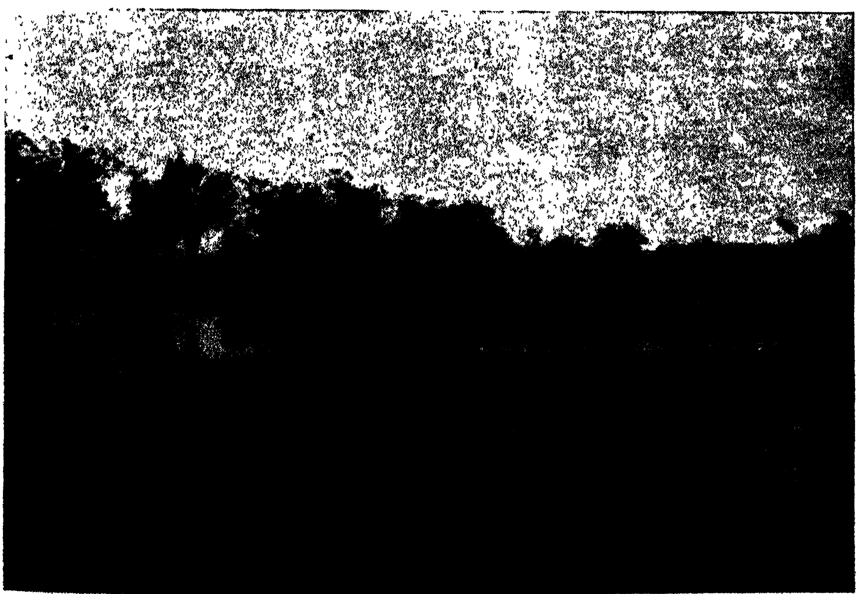


Plate 114.
A LAGOON ON MONAL CREEK ALLUVIAL FLATS.—This area is now cultivated after being drained.

The alluvial soils occur as a narrow belt along Three Moon and Monal Creeks (Plates 111 to 114). They are deep loams to sandy clay loams, usually brown in colour and of good structure. Under cultivation they are very productive, growing excellent maize crops and lucerne and other fodders.

Soils of the Lower Slopes.

These soils abut on the alluvials and generally form a division between the latter and the scrub soils. They are timbered principally with yellow box (*Eucalyptus* sp.) and grey box (*E. populifolia*), interspersed with spotted gum, broad and narrow leaf ironbarks (*E. siderophloia* and *E. crebra*) and bloodwood (*E. corymbosa*). The soils are mostly light-grey, grey-brown, and brown clay loams. They have not a well-developed or stable structure and continued cultivation reduces the surface soil to a very fine powdery state. In this condition they do not readily absorb moisture, and after heavy rain tend to set hard on the surface. It is, therefore, particularly desirable on these soils to practice suitable crop rotation, otherwise loss by soil erosion can be serious. In normal wet seasons they produce good pasturage and good crops of fodder and cotton.

Brigalow Scrub Soils.

These soils originally carried vegetation consisting mainly of brigalow (*Acacia harpophylla*) and belah (*Casuarina lepidophloia*), with wilga (*Geijera parviflora*) predominating in the undergrowth. The surface soils, which are seldom more than 3 inches deep, are light brown, yellow-brown, or brown clay loams and clays. The subsoil is a yellow or grey heavy sticky clay.

Good cotton and other agricultural crops have been produced on this type of land, which is also capable of carrying prolific Rhodes grass pastures.

Resuckering is a problem in brigalow scrub areas, and negligence can result in a regrowth of "whip-stick" brigalow which is more difficult to clear than the original scrub. The general procedure of developing these areas is to fall and burn the scrub, then plant a cash crop or sow Rhodes grass amongst the unburnt timber and stumps. Subsequent firing of the Rhodes grass burns the stumps and suckers which appear. This procedure, however, does not always satisfactorily control suckering. An alternative method consists of ringbarking the original brigalow and several years later firing the area. In general, constant attention is required to control suckering.

Softwood Scrub Soils.

In the main, trees of the softwood scrub areas (Plate 115) are Flindersia (*Flindersia collina*), scrub iron bark (*Bridelia exaltata*), whitewood (*Atalaya hemiglauca*), messmate (*Eucalyptus* sp.), with occasional specimens of iron (steel) wood, which belies the name softwood, being very tough.

These soils are chiefly fairly deep, friable, red or brown loams merging into clay in the deep subsoil. They are of volcanic origin, with the parent rock generally several feet below the surface. In normal seasons, many agricultural crops will grow successfully on soils of this type, as, for instance, on the Mulgildie Plateau (Plates 116 and 117), with includes some 1,500 acres of red volcanic loam.

Plate 115.

SOFTWOOD OR VINE SCRUB, NEAR MONTO.—After falling this type of scrub and burning, Rhodes grass or green panic grass is planted.

The soils of the scrub areas as well as those of the lower slopes are subject to erosion, especially during the summer rainfall season when the rains are sometimes torrential. Farmers who have realised the potential menace of erosion have adopted measures to reduce it by keeping a good grass growth on all areas where erosion is liable to occur. Consequently, erosion has not yet developed to any serious extent. The Soil Conservation Service of the Department of Agriculture and Stock has established soil erosion control demonstrations in the area, featuring methods of forming pasture contour furrows on grassland and of constructing contour banks and waterways on cultivated land. Farmers seeking advice in regard to soil erosion problems are recommended to discuss them with appropriate officers of the Department of Agriculture and Stock.

WATER FACILITIES.

As the principal creeks do not flow continuously, and because of water restrictions during dry periods, it is not possible for farmers on the alluvials to irrigate throughout the year without having recourse to wells. These are usually sunk in positions convenient to the areas intended for irrigation. Water is found at depths ranging from 20 to 35 feet and flows up to 10,000 gallons per hour have been obtained.

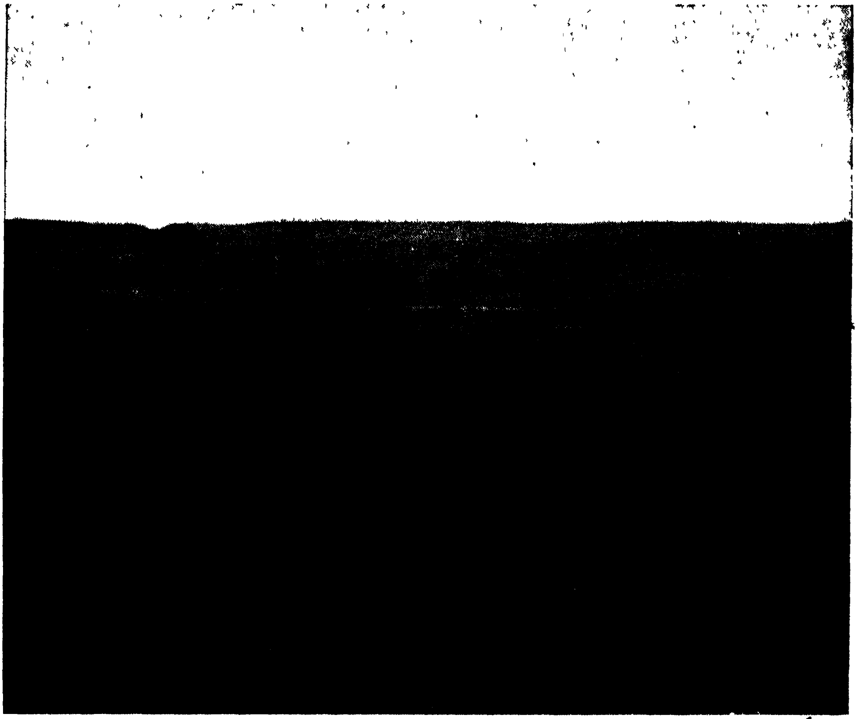


Plate 116.
VIEW FROM MULGILDIE PLATEAU, LOOKING TOWARDS THE MULGILDIE-SELENE AREA.

Plate 117.
VIEW FROM MULGILDIE PLATEAU, WITH MAIZE AND GRAIN SORGHUM IN THE FOREGROUND.

There are approximately 30 irrigation units working in the district, the main use being for lucerne crops for hay and grazing purposes, although some farmers are now producing excellent crops of potatoes, onions, and cotton under irrigation.

The weiring of Monal and Three Moon Creeks is at present receiving attention with a view to providing a more adequate storage of water for dry season use, and these weirs when completed will be a boon to the farms in the vicinity.

On farms of the lower slopes and scrub areas where surface water is not available, water for stock is often provided by the establishment of dams or earth tanks. In many cases bores have been necessary, and in some instances these exceed 150 feet in depth. They do not always provide first-class stock water.

PASTURES.

In common with the greater part of Queensland the pastures of the Upper Burnett are summer growing, producing a flush of green feed following spring and summer rains but rapidly losing their palatability and nutritive value as they mature.

Native Pastures.

The most important of the native grasses which originally occurred on the better class of open country included Queensland blue (*Dichanthium sericeum*), forest blue (*Bothriochloa intermedia*), kangaroo (*Themeda australis*), and a number of star and windmill grasses (*Chloris* spp.). Other species were early spring (*Eriochloa* spp.) and love grasses (*Eragrostis* spp.). As these were subjected to heavy grazing the two blue grasses and kangaroo grass were reduced and their places taken by pitted blue grass (*Bothriochloa decipiens*), bunch spear grass (*Heteropogon contortus*), and white spear or wire grasses (*Aristida* spp.). A season of high rainfall favours the re-establishment of native grasses to a very marked degree. This feature was well demonstrated in the 1948-49 summer season in regard to Queensland blue and forest blue grasses particularly.

On the poorer country—as, for example, ironbark ridges—the main grasses are bunch spear grass, barb wire grass (*Cymbopogon refractus*), love grasses, spear (*Stipa* spp.), wire or white spear, and cane (*Leptochloa* spp.) grasses. Most of these grasses provide inferior grazing, being very unpalatable and non-nutritious when mature. Bunch spear grass, however, provides a large quantity of roughage before seeding.

The spear and wire grasses are a problem to manage, and where they are established it becomes very difficult to avoid burning of the pastures, as it is almost impossible to work among these grasses once they are mature. However, wherever these grasses do not occur the practice of burning pastures should not be followed.

Carrying capacity of these native pastures under normal conditions varies from place to place, but ranges from about a beast to 10 acres to a beast to 7 or 8 acres.

Legumes do not form any appreciable part of the native pastures; nevertheless a number of species occur, most of which are readily eaten by stock. The commonest is the twining species known as the slender sweet root vine or Glycine pea (*Glycine tabacina*), while *Rhynchosia*

minima, a twiner with bright yellow flowers, and the nine-leafed indigo (*Indigofera enneaphylla*) are usually found in the pastures. Other pasture legumes include members of the genus *Vigna, Zornia diphylla*, the emu grasses (*Psoralea* spp.) and rattlepods (*Crotalaria* spp.).

Sown Pastures.

Sown pastures are usually established on the areas originally carrying brigalow or softwood scrub. The original grass stand in these areas was naturally sparse, the most important species being the so-called brigalow grasses (*Paspalidium* spp.). Many thousands of acres of former scrub lands now carry excellent stands of Rhodes grass pasture which, like the native grasses, produces a great bulk of feed in the summer and autumn growing seasons.

Attention of recent years has been focussed on the introduced green panic, blue panic, and buffel grasses. They have a similar growing period to Rhodes grass, and are similarly established on land formerly under scrub. There are indications that green panic will compete better with the poorer native grasses, at least on the less fertile ridge areas, than will Rhodes grass.

Paspalum is another valuable introduced grass; it grows best on the moister low-lying areas along creek flats.

The carrying capacity of these sown pastures is much higher than that of the native grasslands, and may be as high as a beast to 4 acres.

The various native legumes already listed may also be found occasionally in the sown pastures as a result of natural dispersal. Of the introduced legumes, lucerne is the most important and should be used for grazing wherever possible.

WEED PROBLEMS.

As with many other districts in Queensland the main weed problems occur along the creek frontages. Chief among the weeds are Noogoora burr (*Xanthium pungens*), Bathurst burr (*X. spinosum*), and Mexican poppy (*Argemone mexicana*). The last-named is particularly serious because of its very free seeding habit. Brushing, mowing, and the application of weedicides are commonly employed to control weed growth. Nutgrass (*Cyperus rotundus*) and common couch grass (*Cynodon dactylon*) are commonly found in cultivations on the creek bank alluvials. Other common cultivation weeds include red pigweed (*Portulaca oleracea*), convolvulus or bindweed (*Ipomaea plebeia*), flannel weed (*Sida cordifolia*), and bullhead (*Tribulus terrestris*). In addition, on some scrub areas wild salvia (*Salvia coccinea*) and datura (*Datura stramonium*) have become prevalent.

In some softwood scrub areas suckering of a tree commonly called bitter bark (*Alstonia constricta*) is a nuisance. Weedicides containing arsenic are usually applied to control this sucker growth.

AGRICULTURAL CROPS.

The main cultivation areas are situated between Three Moon and Splinter Creeks, within a radius of 20 miles from Monto. As the yearly rainfall occurs for the most part between the summer months of November and March, summer growing crops form the basis of the

crop programme. Fair success, however, is obtained with winter growing crops in years of suitable rainfall. Dairying is the main primary industry of the district and, for the most part, crop production is closely allied to dairying activities.

Cereals.

Maize.—In recent years the acreage sown to this crop has declined because of the unfavourable summer seasons which have occurred. The area planted in 1947-48 was estimated to be more than 1,000 acres, from which over 30,000 bushels of grain were produced. The greater part of the maize grown is used on farms to feed pigs.

Grain Sorghum.—This crop has rapidly gained favour because it is more reliable than maize in a diversity of seasons. It can be grown on a wide range of soil types, shows drought resistance superior to maize, and can be harvested mechanically. In 1947-48 more than 5,000 acres were planted, the yield exceeding 165,000 bushels of grain. Wheatland, Kalo, and Hegari are the most favoured varieties.

Fodder Crops.

Sudan grass, saccharine sorghums, and millets are extensively grown as summer fodder crops on many dairying farms, with good results. Over 11,000 acres were grown in the 1947-48 season.

Winter grazing crops of wheat and oats are used with some success, and in good winter seasons grain is sometimes harvested after the crops have been grazed.

Lucerne.

The area under lucerne in 1947-48 was about 2,500 acres. This crop is grown mainly on the alluvial soils bordering the creeks, where sub-surface water is commonly found within 30 feet. During the past six years irrigation has been favoured and total yields of up to 6 tons of hay per acre per year have been cut, compared with yields of 2-2½ tons from dryland farming.

Cotton.

The rapid development of the Upper Burnett was due in no small measure to the good cotton crops which were harvested in the early years of settlement. This crop was suited to a number of soil types, and very little machinery was required to cultivate it successfully on virgin land. Yields of 1,600 lb. of seed cotton per acre were produced from individual areas varying from 5 to 40 acres in extent. In 1930, the total area under cotton was approximately 14,000 acres, but by 1947 the area had declined to 800 acres, which yielded 420 lb. of seed cotton per acre. Many reasons could be advanced for this decline, but, apart from a succession of unfavourable seasons and lower yields per acre, the main causes have been the relatively better prices for dairy and other farm produce which have prevailed in recent years and the scarcity of suitable labour for harvesting.

The most popular varieties are Miller, Triumph, and New Mexico Acala.

Plate 118.
COTTON BEING HAULED TO CERATODUS IN 1925.

Peanuts.

This crop has not geen grown to any great extent, as the soil types necessary for profitable production are confined to a small tract of country adjacent to the red volcanic loam on the Mulgildie Plateau. Both Virginia Bunch and Red Spanish varieties are grown. In 1947-48 800 acres were grown, but yields were disappointing. Adverse seasonal conditions and a mice plague which occurred at harvesting time were chiefly responsible for the low yields.

Other Crops.

Small areas of potatoes are grown mainly for local consumption, but in the 1948 season 204 tons were marketed outside the district from 62 acres. The popular varieties are Factor, Carman, and Bismarck; late summer and early autumn planting is favoured.

Pumpkins of the Beaudesert or Queensland Blue variety are cultivated to a small extent, chiefly for home consumption. A small acreage is also grown for cattle fodder.

HORTICULTURAL CROPS.

Horticultural cropping is not of any economic importance other than to provide fresh vegetables and fruit for the farmer's own requirements and for local shops during a part of the year. The greater portion of the local demand for fruit and vegetables, however, is met by outside markets.

Citrus is being grown commercially on the Burnett River, near Ceratodus, but these orchards are only just coming into production.

THE DAIRYING INDUSTRY.

The small herds which were introduced into the district during 1925 and 1926 did not produce sufficient to warrant a local processing factory. Consequently, cream had to be transported by road to Ceratodus, 40 miles away from Monto, and thence by rail to Mundubbera. Under these conditions the industry made no progress until 1928, when the railway was constructed closer to Monto. This improvement gave an impetus to the growth of the industry, and in 1928 the Monto butter factory of the Port Curtis Co-operative Dairy Association was erected. Since then, herds have been improved and numbers have increased, and a prosperous dairying industry has now been developed.

Production figures of the Monto butter factory have ranged from 293 tons in 1929-30 to 2,144 tons in 1938-39. Production declined during the war years, but in recent years has begun to improve.

A pig-raising industry has developed in conjunction with dairying, and approximately 15,000 pigs were marketed from the district in 1947-48.

Conservation of fodder is a practice followed by many dairymen, the most favoured method being the production of lucerne and millet hays and their storage in haysheds. Some interest has been shown in tower silos for silage but where silage is conserved it is usually stored in the less expensive and more convenient trench silos.

Jersey and A.I.S. breeds of dairy cattle are equally favoured. Generally, dairy farmers are showing greater interest in herd improvement, and the intake of pure-bred stock into the district has increased.

Most dairy holdings range from 250 acres on the alluvial soils and brigalow scrub areas to 600 acres on the lower slope and softwood scrub areas.

THE GRAZING INDUSTRY.

Outside the main agricultural areas there is much good to medium grazing land, and with present-day prices of cattle the grazing industry is a thriving one. Individual holdings vary in size from 5,000 to 10,000 acres, and the native pasturage is utilised mainly for store cattle and fattening purposes.

Herefords are the most popular breed on these areas, but in recent years there have been introductions of Aberdeen Angus.

It is estimated that during the season 1947-48 beef cattle valued in excess of £100,000 were railed from the district.

FORESTRY.

During the past 10 years or so a great tract of pine forest in the range country between Kalpowar and Builyan has been opened up for supervised exploitation. Many millions of super feet of timber have been cut from this area and reafforestation has been carefully carried out.

The Coominglah Range country has been declared a Forest Reserve for the care and production of hardwood timbers, chiefly spotted gum, ironbark, and bloodwood. Two sawmills are located at Monto and one at Abercorn. Several millions of super feet of hardwood are milled annually in the district.

Harvesting, Handling and Packing Pineapples.

C. G. WILLIAMS, Supervisor, Preparation and Transport, Horticulture Branch.

THE development of a satisfactory trade in fresh pineapples depends on the fruit being in a sound and palatable condition. The stage of maturity at which the fruit can be picked, and the methods of harvesting, handling and packing, are largely determined by the ultimate destination of the fruit.

The requirements for markets in Brisbane, Sydney and Melbourne have been fairly well established, but careful handling methods and the control of wastage, particularly that due to water blister, still require greater attention from growers. The normal pack for these markets is of average grade and suitable only for town trade. However, there is a demand for a pack of a higher standard comparable with the "Extra Fancy" grade of apples and pears. To this end, specifications have been drawn up for a "Special Pack" scheme, and an attractive label under which this fruit may be marketed can be obtained from the Committee of Direction of Fruit Marketing. This label is virtually a guarantee of quality, and it is anticipated that such fruit will command a premium over the normal pack. For export to New Zealand, longer transit and additional handlings are involved; but, as a result of trial consignments during the 1948-49 seasons, it is now possible to make recommendations in regard to picking maturity and methods of packing for the New Zealand market.

SELECTION OF FRUIT.

In selecting fruit for the fresh fruit market, particular attention should be given to the rejection of fruit not of normal type. The following types of fruit should be excluded from all packs:—

(*a*) Fruit visibly affected with sunburn, frost injury, yeasty rot, black speck or bruises;

(*b*) Fruit showing any leakage of juice at packing, whether from bruises, growth cracks or other causes;

(*c*) Fruit with more than two tops;

(d) Fruit with knobs or slips on base of fruit;

(e) Fruit without tops or with aborted, dwarfed or deformed tops;

(f) Malformed or crippled fruit;

(g) Fruit whose stalks have been wholly or partly broken before maturity. Such fruit is invariably of poor quality and subject to black heart.

Very careful selection of fruit is essential for the special and export packs, and only fruit of the highest quality should be included.

HARVESTING.

Removal of the Fruit from the Plant.

During the summer months, when water blister is likely to be prevalent, fruit for all markets should be cut from the plant with a long, stout-bladed, sharp knife, leaving a basal stem approximately ½-1 inch long. Fruit marketed under the special pack scheme, or destined for New Zealand, should be cut throughout the year. At the time of packing, the stem should be trimmed back so that it projects not less than ¼ inch below the lowest portion of the base of the fruit.

Stage of Maturity.

The stage of maturity at which fruit should be picked depends to a large extent on its ultimate destination. Fruit grown in close proximity to the markets can be picked in a fairly forward condition. Fruit destined for Sydney and Melbourne markets may be picked at a stage slightly more advanced than that to be consigned to Adelaide or New Zealand. For the latter markets, the colour at the time of picking must not be more than the minimum standard prescribed in the regulations under "*The Fruit and Vegetables Act*." Under these regulations, the fruit must be fully developed and (1) during the months of October to March show a distinct tinge of yellow colour at the base and contain a total sugar content of the juice of not less than 12 per. cent.; (2) during the months of April to October be half yellow colour at the base and contain a total sugar content of the juice of less than 10 per cent.

Handling after Picking.

While careful handling methods from the plantation after picking are essential irrespective of the ultimate destination of the fruit, the requirements in this respect are particularly exacting for fruit exported to New Zealand, as the cases are handled a considerable number of times before they reach the consumer. After the fruit is removed from the plant, it may either be carefully placed on top of the plants in the row for subsequent collection in a suitably sized basket or be collected and carried in the arms of the operator or placed directly into the basket, which should be padded with woodwool and free of any internal projection.

When the pineapples are being transferred from the harvesting basket, or from the arms of the operator, they should as far as practicable be placed in a harvesting box which will contain fruit of the same size. This rough size grading in the field will save excessive handling

of the fruit prior to final grading at the time of packing. Moreover, if this field grading is done effectively the fruit need only be handled three or four times during the whole operation.

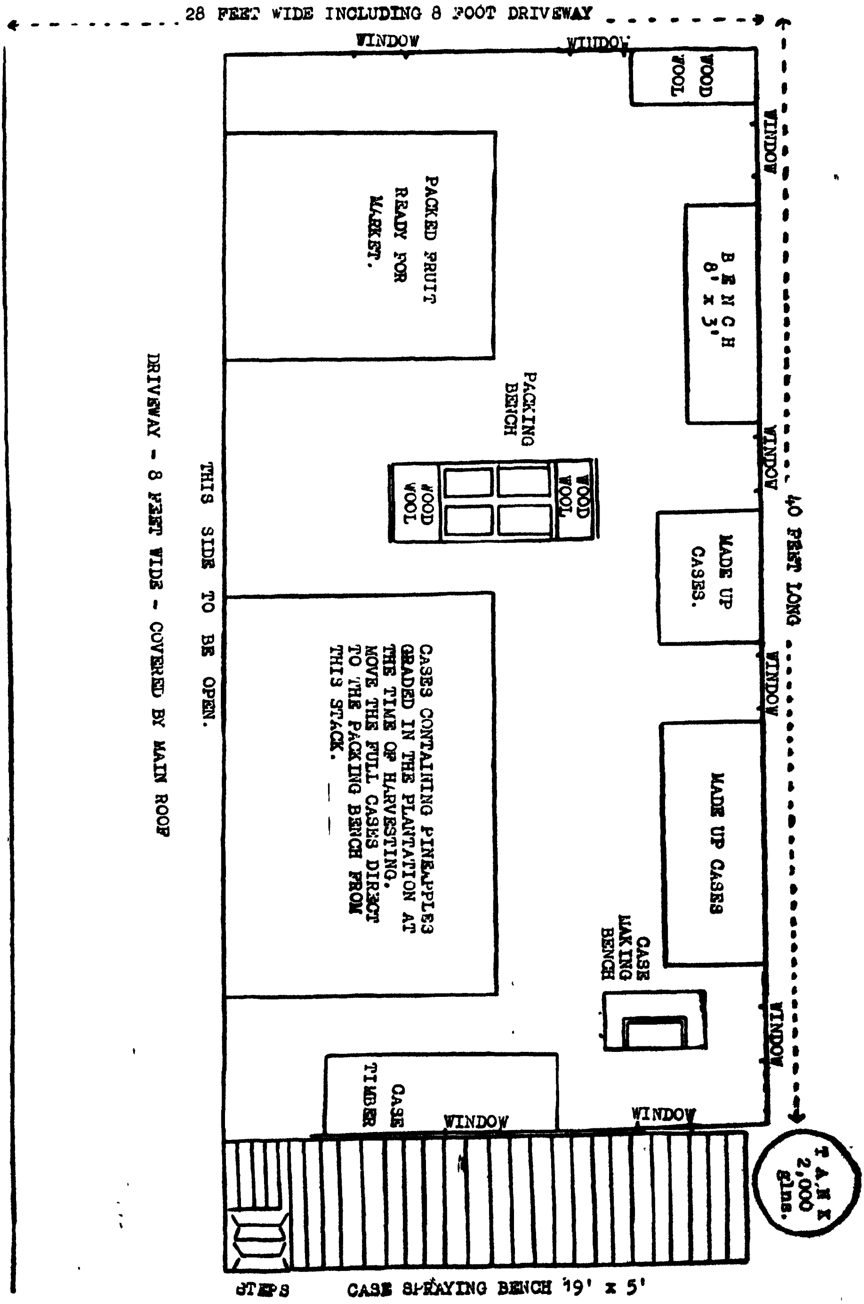


Plate 119.

GROUND FLOOR PLAN OF PINEAPPLE PACKING SHED.

Harvesting containers such as the tropical case or the pineapple factory case, preferably the latter, should be placed at the end of the plantation rows and protected with woodwool or other suitable padding material.

Transport from the Plantation to the Packing Shed.

The most suitable harvesting conveyance is a rubber-tyred vehicle with trailer attached; but whatever type of container or transport vehicle is used, the fruit should not be placed in a high stack, as this is conducive to bruising. If the pineapples are packed above the top of the harvesting box, then the boxes should be stacked only one high on the transport vehicle. If they are packed below the top of the case, the cases can be stacked two or three high and woodwool placed between each tier. A horse drawn slide is not suitable for the transport of pineapples; but, where this type of conveyance is necessary on steep hills, the harvesting cases must not be stacked more than one high.

The Packing Shed.

At the packing shed the harvesting cases should be unloaded onto the floor of the shed and placed in stacks or in single case units containing each grade size. To facilitate packing, the cases should be placed as near as possible to the packing stand.

To reduce the number of handlings during packing, a packing stand which will accommodate two or four cases of fruit should be a moveable part of the packing shed equipment. A floor plan of a model packing shed showing the position of a four case packing stand is illustrated in Plate 119.

Packing Shed Operations.

Cases.

All fruit should be packed in clean cases. New cases must be used for export, but second-hand cases from which all previous marks have been obliterated can be used for local or interstate trade. The tropical case of internal measurements 24¾ in. long x 12 in. deep x 12 in. wide is used for all markets, but in addition a smaller box, designated "the pineapple case," of internal measurements 24¾ in. long x 10 in. deep x 12 in. wide may be used for export. The tropical case is suitable when grading is accurate. However, in pineapple plantations grading is by hand, and accurate grading is difficult. The smaller case has given the more satisfactory results in export, but necessitates the use of a greater amount of woodwool and timber per unit weight of fruit.

Cases described as "Tropical" and "The Pineapple" shall be constructed from softwood or hardwood in accordance with the following specifications:—

TROPICAL CASE.

1. Each end shall be 12 inches wide by 12 inches deep by ¾ inch thick and consist of two pieces.

2. Each side shall be of three boards each 26¼ inches long by 5/16 inch thick and aggregate 10 inches in width. An aperture ⅝ inch wide shall be allowed between the boards.

3. The top and bottom shall each be of two boards each 26¼ inches long by 5/16 inch thick and aggregate not less than 11½ inches and not more than 12 inches in width.

4. Two cleats each measuring 12 inches long by 2 inches wide by 5/16 inch thick shall be used to join the two pieces of the end boards and shall be placed parallel to the sides of the case.

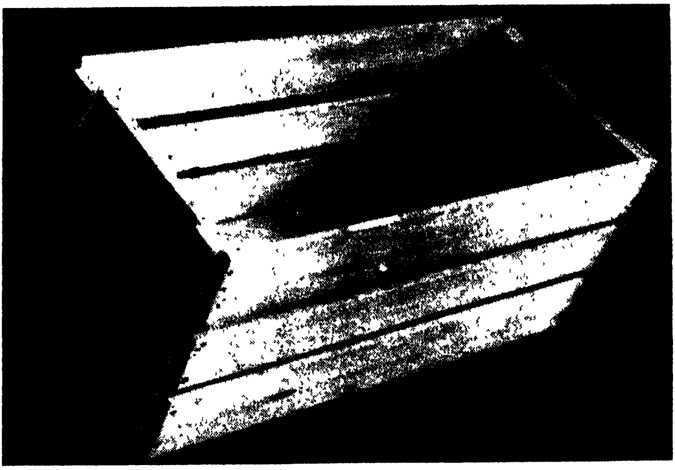


Plate 120.

THE TROPICAL CASE.—Showing method of making up, with the sides overlapping the top and bottom of the case to an extent equal to the thickness of the top and bottom boards. The cleats are placed parallel to the sides of the case.

PINEAPPLE CASE.

1. Each end shall be 12 inches wide by 10 inches deep by ¾ inch thick and consist of two pieces.

2. Each side shall be of two boards each 26¼ inches long by 5/16 inch thick and aggregate 10 inches in width. An aperture ⅝ inch wide shall be allowed between the boards.

3. The top and bottom shall each be of two boards each 26¼ inches long by 5/16 inch thick and aggregate not less than 11½ inches and not more than 12 inches in width.

4. Two cleats each measuring 10 inches long by 2 inches wide by 5/16 inch thick shall be used to join the two pieces of the end boards and shall be placed parallel to the sides of the case.

Packing Procedure.

Prior to the commencement of packing, one or two boxes of the field graded pineapples should be moved from the intake stack onto the packing stand. The packer will find that, if two or three market cases are conveniently arranged on the opposite side of the stand from the harvesting boxes, he can pack two or three colour or grade sizes simultaneously. This procedure will expedite packing and eliminate extra handling of the fruit when grading for size in the field is not accurate.

Fruit in the packed case should be uniform in size. For special and export packs it should also be uniform in colour. Oversized tops may be trimmed back to not less than 2 inches from the solid core of the top. Further trimming may result in water blister development.

Grading Rings.

Quite suitable grading rings may be made from heavy gauge wire or by cutting holes of a required diameter out of 3-ply or pine board. A pineapple that will pass through a 4-inch ring but which will not pass through a 3¾-inch ring is classified as 3¾ grade size. For

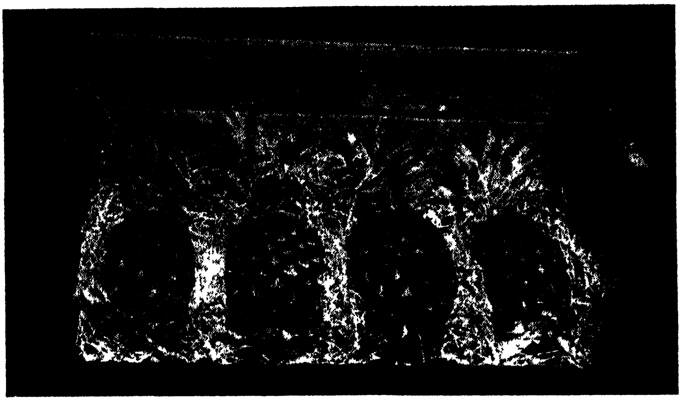


Plate 121.
11 Count Pack.—Bottom Layer.

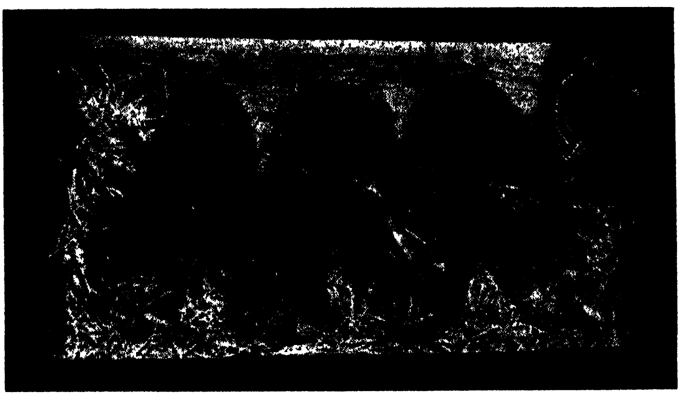


Plate 122.
11 Count Pack.—First and Second Layers, 4 x 3.

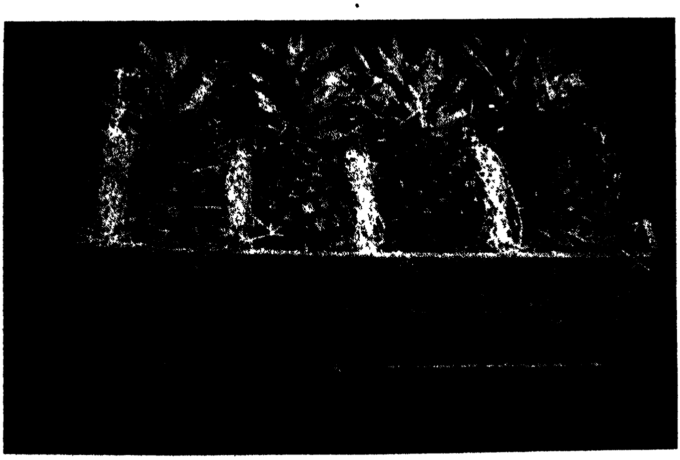


Plate 123.
11 Count Pack.—Top View of Finished Case. Three Layers, 4 x 3 x 4.

trade purposes the size grade is referred to by the number of pineapples in the case, such as 11, 12, 14, &c., count. Each variety may vary in shape, but provided proper grading methods are used no difficulty should be experienced in packing fruit of regular shape. It is advisable to set aside irregularly shaped pineapples until sufficient fruit of the same size is obtained to pack a full case. Large pineapples are not welcomed by the trade, and fruit larger than 11 count should be forwarded to the factory. Pineapples smaller than 27 count are suitable for local market only.

Method of Packing.

All packs should have the fruit placed across the case with the butts against the side of the case. There are two types of packs—namely, the straight pack for counts of 11-14 and the "head and tails" pack for counts of 15-36. The former pack is sometimes used for a count of 15.

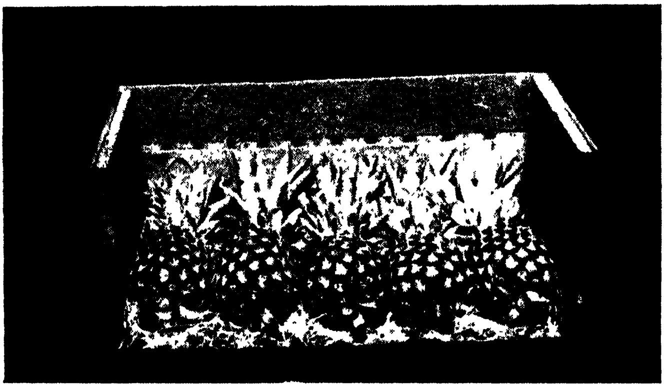


Plate 124.
14 COUNT PACK.—Bottom Layer.

Plate 125.
14 COUNT PACK.—Showing Position of Layers. Three Layers, 5 x 4 x 5.

For counts of 11 (Plates 121-123) and 12, the straight pack consists of three layers of fruit of a single row with the butt ends in each layer touching the same side of the case. The pineapples in the second layer are reversed so that the tops touch the same side of the case as

the butts in the first and third layer. This method of packing will also apply to counts 14 (Plates 124-126) and 15 when the long, square-shouldered type of fruit is being packed. For these counts a tighter pack is sometimes obtained by reversing the end or centre pineapple in each layer.

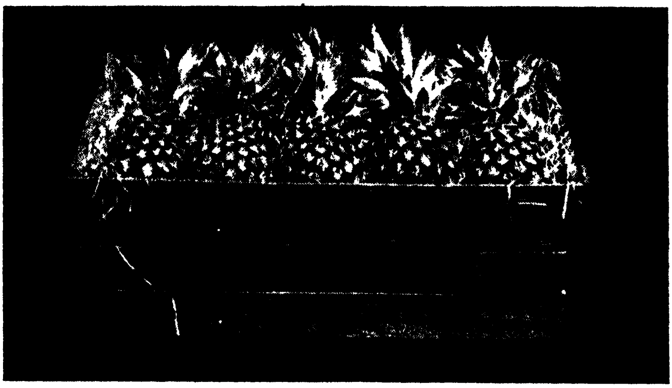


Plate 126.
14 COUNT PACK.—Top View of Finished Case.

Plate 127.
21 COUNT PACK.—Bottom Layer.

Plate 128.
21 COUNT PACK.—Showing Position of Layers. Three Layers, 7 x 7 x 7.

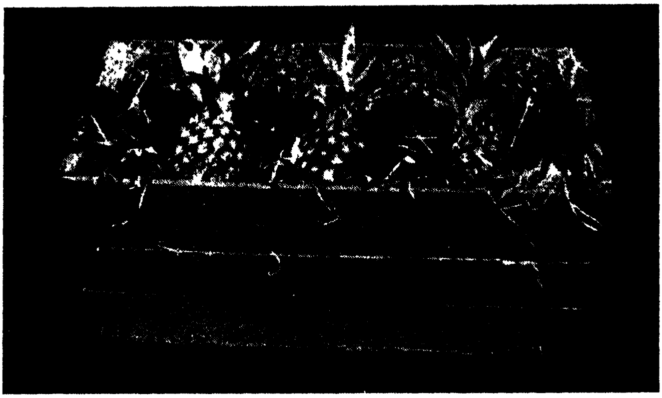


Plate 129.
21 COUNT PACK.—Top View of Finished Case.

Normally shaped pineapples of counts 15, 18, 21 (Plates 127-129), 24 and 27 are packed in three layers each of two rows and placed so that each alternate fruit has its butt end touching the opposite side of the case. Pineapples of counts 28, 32 and 36 are packed in a similar way except that four layers are used.

When placing the pineapple in the case, the packer should make the movement as he places the packing material around the bottom, sides and base of the fruit. Each fruit in the upper layers should be placed between the spaces of the fruits in the lower layer and not directly on top of the fruit.

Packing Material.

Woodwool and blady grass are used as packing materials, but the latter can only be used for fruit sold within the State. Packing material should be used on the top and bottom of the case, between each fruit, and at the base of the fruit where it touches the case. For special and export packs, approximately 2½ to 3 lb. of woodwool should be used per case. For other packs, 1½ lb. of woodwool per case is sufficient.

Height of Fruit in the Case.

When finished, the top layer of fruit should not be above the case, as sufficient space should be available for a protective layer of packing material. The slight pressure exerted when the case is lidded should result in a firm pack.

Packing Chart.

The methods of packing the various counts listed in Table 1 are recommended for fruit consigned to local markets and to Sydney and Melbourne.

TABLE 1.

Count (Number of Fruit to Case).	Approximate Diameter of Fruit.	Number of Layers in Case.	Number of Fruit in each Layer.
	In.		
11	5¼—5½	3	4 x 3 x 4
12	5⅛—5¼	3	4 x 4 x 4
14	5 —5⅛	3	5 x 4 x 5
15	4¾—5	3	5 x 5 x 5
18	4½—4¾	3	6 x 6 x 6
21	4¼—4½	3	7 x 7 x 7
24	4 —4¼	3	8 x 8 x 8
27	4	3	9 x 9 x 9
28	4	4	7 x 7 x 7 x 7
32	3¾	4	8 x 8 x 8 x 8
36	3½	4	9 x 9 x 9 x 9

In the special and export packs, and for fruit likely to receive a considerable number of handlings, more packing material is required to protect each individual fruit against bruising, and the methods of packing shown in Table 2 and illustrated in Plate 130 are therefore recommended.

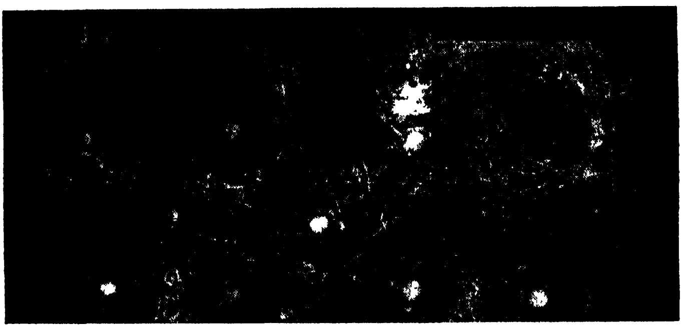


Plate 130.

PACKING FRUIT FOR THE SPECIAL AND EXPORT PACKS.—The fruit is cut from the plant and adequately protected with woodwool.

TABLE 2.

Count (Number of Fruit to Case).	Approximate Diameter of Fruit.	Number of Layers in Case.	Number of Fruit in each Layer.
	In.		
11	5	3	4 x 3 x 4
12	4¾	3	4 x 4 x 4
14	4½	3	5 x 4 x 5
15	4¼	3	5 x 5 x 5
18	4	3	6 x 6 x 6
21	3¾	3	7 x 7 x 7
24	3½	3	8 x 8 x 8
27	3¼	3	9 x 9 x 9

It will be observed that fruit of 4½ inch diameter, which can be packed as an 18 count in Table 1, can only be packed as a 14 count in Table 2. The disparity between Tables 1 and 2 becomes more apparent as the fruit is reduced in size, and fruit of 32 count in Table 1 can only be packed as a 21 count in Table 2.

REQUIREMENTS FOR VARIOUS MARKETS.

Local and Interstate Pack.

For sale within Australia the fruit must comply with the grading regulations of the State in which the consignments are eventually sold. This fruit must be sound, clean, mature and the exposed surfaces of the package representative of the contents as a whole. The case should be branded with—

(i.) Grower's name or registered brand and his address.

(ii.) The name of the variety.

(iii.) The count.

(iv.) The consignee's brand.

Special Pack.

A grower may make application to the Department of Agriculture and Stock for permission to market his fruit under the Special Pack Scheme. He will be entitled to use the special label printed by the Committee of Direction of Fruit Marketing provided he cuts the fruit from the plant, handles it carefully, keeps the shed and environs in a clean condition, and packs only fruit of normal type, of one maturity and according to methods recommended in Table 2. Counts less than 14 or more than 24 should also be excluded. Fruit marketed under the special pack label has proved very suitable for country order trade and meets the demands for a pack of high grade quality. The same conditions as for local and interstate packs apply in regard to grading regulations.

Export Pack.

Fruit consigned to countries outside Australia must comply with the Commonwealth Export (Fresh Fruit) Regulations. Under these regulations, the export of pineapples is prohibited unless the fruit has been prepared in a registered export establishment. Any person who is the owner or occupier of any premises used for the receipt, processing, packaging or storage of pineapples may apply to the Department of Agriculture and Stock, on the prescribed form, for the registration of his premises as an export establishment. If the premises are constructed, equipped and operated in an efficient and hygienic manner and comply with the following conditions they may be registered as an export establishment:—

(i.) The establishment shall be of such a nature as to minimise any harbourage for fungi or insects and any contamination of the fruits by foreign substances during the operations of stacking, handling, loading, processing, grading and packing.

(ii.) The establishment shall be so constructed as to be sufficiently lighted for the purposes of efficient inspection and for the operations of the packing shed.

(iii.) The establishment shall be ventilated in a manner approved by an officer.

(iv.) The floors of the establishment shall be constructed of concrete or other suitable material, which shall permit of rapid and effective cleansing.

(v.) The plant and equipment shall be of types approved by an officer.

The trade description shall be placed on one end of each case and shall set out:—

(*a*) In letters or figures at least ¼ inch in height if printed on the cases or applied by means of printed paper labels, and at least ¾ inch if stencilled on the cases, the word "pineapples" and the number of pineapples contained in each case.

(*b*) In letters at least ½ inch in height, the word "Australia," the State or Territory in which the fruit was produced, the grower's name or registered brand and the number of his registered establishment.

Growers who are prepared to pack for export can expect a return for their fruit greater than that received for their normal interstate pack.

FACTORY FRUIT.

Harvesting.

In order to obtain fruit which will be acceptable for factory purposes, care must be exercised in handling and preparing the fruit. Prior to the fruit reaching the packing shed, treatment should be the same as that given to fruit intended for the fresh fruit market, except that fruit for factory may be snapped throughout the year. Maturity is judged more on internal than on external colour. The fruit should be harvested and forwarded when it is considered to have the necessary internal colour required for canning. The cannery requires fruit which at the time of processing shall be semi-translucent yellow in colour. Growers know from experience that relationship between external and internal colour varies with the site and locality in which the fruit is grown and must use their discretion as to when the fruit should be harvested. The external colour will vary from the first tinge of yellow at the base for the large fruit up to half colour for the smaller fruit, and maturity and colour vary as between the ratoon and the plant crop. The grower can best judge the internal colour by cutting several fruits. Allowance must be made for the ripening which will occur during transit. Fruit which is over-ripe is not satisfactory for processing, as it has a fermented flavour and the amount of trimming required is excessive; on the other hand, immature fruit cannot be used as it gives an unsatisfactory canned product.

Grading and Packing.

When the fruit reaches the packing shed, the tops and any knobby basal projections are removed. This should be done by cutting with a sharp knife, as the breaking off of knobs and tops by hand causes considerable damage to the fruit and affords a means of entry for fungi and yeasts. Considerable wastage from water blister frequently

occurs through this practice. When the fruit is trimmed it is placed direct into factory cases or crates. The grades required by canneries are described below:—

(a) *Grade* 2 should be 5 inches or more in diameter; that is, the fruit must not pass through a 5 inch grading ring. The pineapple must be true to type.

(b) *Grade* 1 should be 4 inches or more in diameter and less than 5 inches; that is, the pineapple must not pass through a 4 inch grading ring. Fruit should be true to type and have a full length of not less than 5 inches.

(c) "Smalls" should not be less than 3¾ inches in diameter and 4½ inches in length. If the fruit is smaller than "smalls" it must be fully developed and not less than 3 inches in diameter and 4 inches in length, but this fruit must show half colour on delivery at the factory.

Cannery pineapples are received by the C.O.D. for distribution to factories subject to the following conditions:—

(1) At loading centres where C.O.D. loaders are employed pineapples will be accepted only through the C.O.D. loader.

(2) All fruit must be freshly picked and loaded in a sound condition.

(3) Only smooth leaf varieties will be accepted.

(4) Fruit must be loaded on regular days as and when instructed.

During the winter months, quite a proportion of the fruit may be conical; this abnormally shaped fruit must be included in the lower grade. Grades must be marked plainly in white chalk on both ends of the cases as follows:—Grade 2 with a numeral "2"; Grade 1 with a numeral "1", "smalls" with a letter "S".

The C.O.D. Inspectors have been instructed that (a) if a case of Grade 2 contains one fruit which is undersized, the case will be graded down; (b) if a case of "ones" contains 10 per cent. or more of undersized fruit, the whole fruit must be graded down; and (c) if a case of smalls contains 10 per cent. or more of undersized fruit, the whole case will be rejected.

Branding.

All cases must be weighed and the tare to the nearest pound stencilled plainly on the top board of each side of the case. The cases must be branded with the grower's name and station underneath the tare on each side of the case. To facilitate the return of empty cases, all cases must be branded on each end with the code letter or letter allotted to the sending station. When the code is comprised of two letters, these must be shown together.

Cannery pineapples are carried on the railway on a case rate basis and it is therefore necessary that cases be packed to capacity. Care should be exercised to ensure that no fruit projects above the top of the case. The case should contain at least 64 lb. of fruit.

Further information on the basis of acceptance and other cannery requirements can be obtained from the C.O.D.

The methods of packing pineapples for factory purposes are illustrated in Plates 131 to 136.

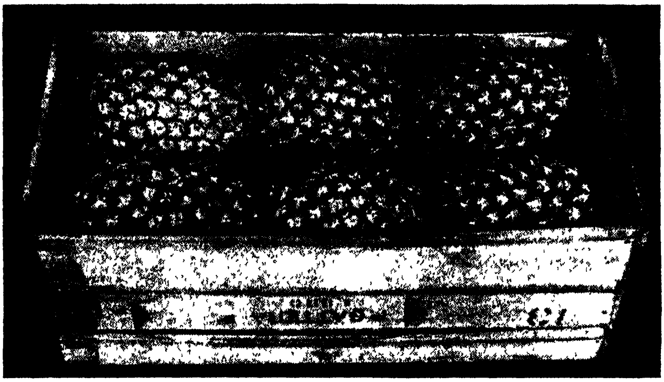


Plate 131.

FACTORY PACK USED FOR VERY LARGE FRUIT OF GRADE 2, COUNT 14.—Bottom layer, 6 lying on the side; middle layer, 2 lying on the side; top layer, 6 lying on the side.

Plate 132.

FACTORY PACK USED FOR LARGE FRUIT OF GRADE 2, COUNT 16.—Bottom layer, 9 standing upright; top layer, 7 (3 pines have been removed to show the bottom layer), 3 lying on the sides lengthwise, and 4 lying on the sides at angle.

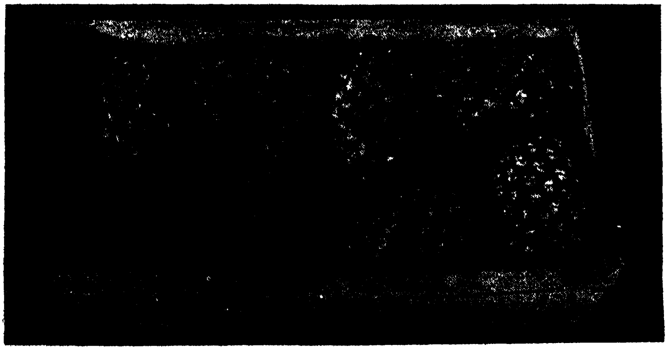


Plate 133.

FACTORY PACK USED FOR SHORTER FRUIT OF GRADE 2, COUNT 17.—Showing arrangement of the fruit in the top layer.

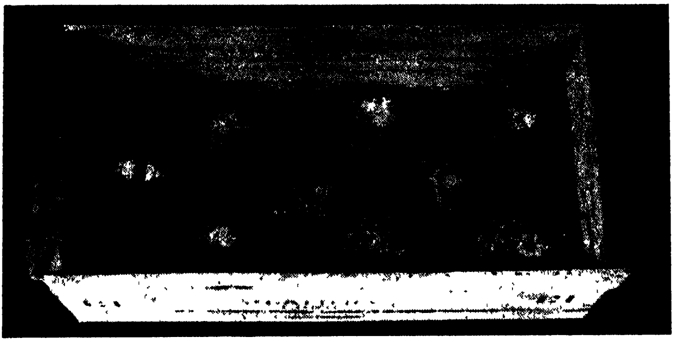


Plate 134.

FACTORY PACK USED FOR SHORTER FRUIT OF GRADE 2, COUNT 17.—Showing the arrangement of the fruit in the bottom layer.

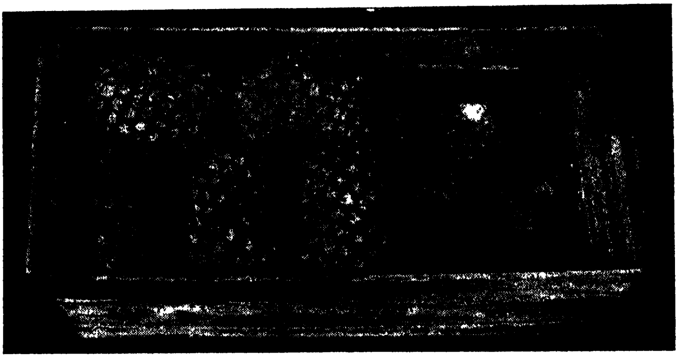


Plate 135.

FACTORY PACK USED FOR LARGE FRUIT OF GRADE 1, COUNT 20.—Top layer, 8 lying on the sides (3 pineapples have been removed to show the bottom layer); bottom layer, 12 pines standing upright.

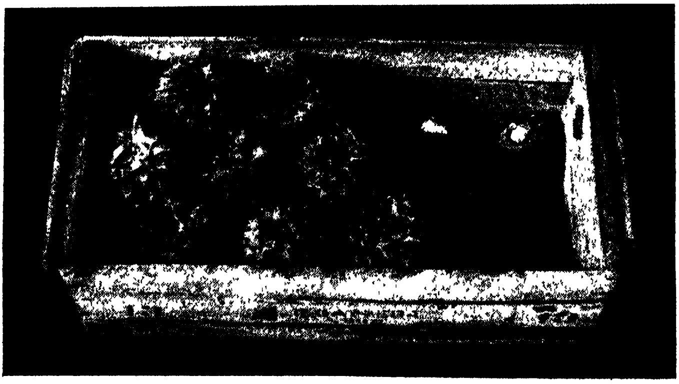


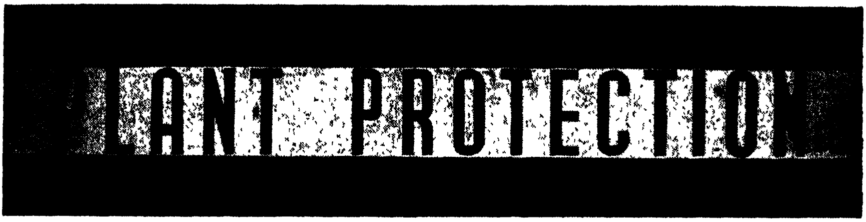
Plate 136.

FACTORY PACK USED FOR SMALLER FRUIT OF GRADE 1, COUNT 27.—Both layers standing upright; top layer contains 13 fruit; bottom layer contains 14 fruit.

Control of Wastage.

Wastage is likely to occur, especially in the summer months, through the development of water blister and yeasty rot. The two diseases sometimes occur together, but the former is more common and causes considerable wastage during the humid period of the summer. For the control of these diseases, strict sanitation in the field and packing shed should be practised and very careful handling methods adopted when the disease is likely to occur. All discarded fruit tops and other pineapple debris should be removed from the packing place within 24 hours and either buried or spread out in a heap at least 200 yards from the packing place. The packing shed and equipment should be kept clean, and disinfected once a week by spraying with a 2½ per cent. solution of formalin (4 fl. oz. per gallon). The presence of wounds on the fruit provides invasion points for the fungus. Such wounds are caused by injuries received during handling, by sunburn, knobs cut or knocked off, cut or broken tops and growth cracks. Fruit for the fresh fruit market or for factory should be handled carefully and cases suspected of being contaminated should be sprayed with a formalin solution.

MEMBERS OF THE MURGON, WONDAI, MONDURE AND CLOYNA JUNIOR FARMERS' CLUBS RECEIVING INSTRUCTION IN THE POINTS OF A DAIRY COW.



Codling Moth and Light Brown Apple Moth Control Experiments, 1948-49.

A. W. S. MAY, Entomologist, Science Branch.

THE value of DDT for codling moth* control in apples in Queensland is now well established. Though methods for coping with the woolly aphis† and mite‡ populations that arise following repeated use of DDT in the orchard have been devised, these are additions to an already intensive spraying programme. The results of experiments conducted in the 1947-48 season suggested that a possible reduction in the number of DDT cover sprays could be achieved without detracting greatly from the control of codling moth. Accordingly, the 1948-49 season's experiments were concerned solely with comparing several DDT schedules differing in number and time of cover spray applications.

EXPERIMENTAL PROCEDURE.

The original intention was to include a calyx spray application as a treatment in the trial schedules, but severe frost in the Stanthorpe area in late October destroyed the greater proportion of the crop on the orchard where the experiment was located, and this section of the work had to be abandoned. After suitable modification of the original plan of procedure, two almost identical experiments using the late maturing Granny Smith variety were laid down on widely separated orchards free from frost damage.

The first cover spray was applied in early November. Both orchards had received a dormant or semi-dormant oil spray for mite control and a calyx spray of lead arsenate before the experimental treatments were applied. An early to midsummer treatment of hexaethyl tetraphosphate was uniformly applied to all trees for woolly

TABLE 1.

Schedule.	DDT Strength Employed.	Cover Sprays Applied.					
		1-11-48.	24-11-48.	14-12-48.	5-1-49	25-1-49.	15-2-49.
	Per cent.						
1 ..	0·1	√	√	√	√	√	√
2 ..	0·1	√	√		√		√
3 ..	0·1	√	√		√		
4 ..	0·1	√	√		√	√	
5 ..	0·1	√			√		
6 ..	0·2	√			√		
7 ..	0·2	√					
8 ..	0·1	√					
9 ..	Nil						

* *Cydia pomonella* L.

† *Eriosoma lanigerum* Hausm.

‡ *Bryobia praetiosa* Koch and *Tetranychus urticae* Koch.

aphis and mite control. Eight DDT schedules were tested; unsprayed plots were included to gauge codling moth activity within the experimental areas.

The nine treatments were as shown in Table 1. All sprays were prepared from emulsion concentrates.

RESULTS.

The trials were harvested at the end of March and the numbers of sound fruit and of those damaged by codling moth and light brown apple moth were determined; at intervals throughout the season all windfalls were similarly sorted. The combined results from these two determinations enabled fruit losses to be assessed on a total crop basis. A summary of the results is given in Table 2.

TABLE 2.

Schedule.	Experiment No. 1.			Experiment No. 2.		
	Percentage of Sound Fruit.	Percentage of Damaged Fruit		Percentage of Sound Fruit.	Percentage of Damaged Fruit.	
		Codling Moth.	Apple Moth.		Codling Moth.	Apple Moth.
1. (6 cover sprays) ..	92·2	3·0	2·3	93·8	3·0	2·1
2. (4 cover sprays) ..	79·3	5·9	9·0	88·6	5·7	3·5
3. (3 cover sprays) ..	81·7	9·2	8·2	83·2	11·6	4·9
4. (4 cover sprays) ..	84·5	6·0	5·9	90·0	7·0	2·5
5. (2 cover sprays) ..	64·5	15·4	19·3	76·3	16·0	6·6
6. (2 cover sprays) ..	80·4	12·6	4·2	82·9	9·6	5·3
7. (1 cover spray) ..		Not used		86·8	7·8	4·3
8. (1 cover spray) ..		Not used		73·5	16·7	8·9
9. (no treatment) ..	56·6	27·3	16·9	61·5	27·2	10·6

The figures for codling moth damage in the above table are based on both stung and wormy fruit. Fruit in the former category are sound, the majority actually being marketable. The percentage stung of all codling moth damaged fruit in the total crop was highest for schedule 1 and decreased with the number of DDT sprays applied, being lowest for schedules 5, 8, and 9.

DISCUSSION.

Codling Moth.

In comparison with figures for previous seasons' experiments, codling moth infestation in the two experimental blocks can be classed as moderate. A persistent moth population was required to check adequately the efficacies of the several schedules under test, and the inclusion of the obviously inadequate schedules 5, 8 and 9 served a twofold purpose:—it enabled comparative evaluation of respective cover sprays, and also ensured an appreciable pest population throughout the season. Under such conditions, larger differences between the more effective schedules 1, 2 and 4 were more likely to occur.

The first cover spray, which was applied at the late spring peak of moth activity, is considered to fulfil an important role and was included in all schedules. Later sprays were applied when moths were relatively inactive, as shown by trapping records, and though the control exercised individually by these sprays was not great, their

combined effect appreciably supplemented the partial control obtained with the first cover spray. The first, second, fourth and fifth or sixth cover sprays are essential for control, and though the first and fourth cover sprays coincided with expected periods of major moth activity, they are not sufficient in themselves. The inclusion of cover sprays 2 and 5 or 6 greatly increased the efficacy of spraying. It seems that an effective schedule is one that, firstly, copes with the late spring peak of moth activity, and secondly, prepares for any reinfestation that may occur in midsummer and late summer.

The results also suggest that two applications of 0.2 per cent. DDT were of greater benefit than two similarly timed applications of 0.1 per cent. strength, but for the same DDT load on the trees, two 0.1 per cent. sprays three weeks apart were more beneficial than one application of 0.2 per cent. strength.

Light Brown Apple Moth.

Excellent control of this pest was obtained with the full cover spray schedule of six applications, but results with the other schedules differed from the corresponding degrees of control exercised against codling moth. These differences can be explained by pest behaviour. Both pests showed a peak of activity in late spring, but only the light brown apple moth was again very active throughout January. From an examination of the results, it is seen that the second and fifth cover sprays exercised considerable benefit against this pest, while the first and fourth cover sprays were of less importance for light brown apple moth control than they were for the prevention of damage by codling moth. Also, the greater benefit obtained by two applications of 0.2 per cent. DDT against this pest than against codling moth stresses the need for protracted tree protection during the all-important late spring and midsummer periods.

Mites.

Both experimental blocks received a dormant or semi-dormant oil spray followed by an application of hexaethyl tetraphosphate, plus spreader, in summer. Bryobia mite and red spider were active on experimental trees, though populations were not excessive. Differences were not apparent between the various DDT schedules employed, though unsprayed plots showed slightly less mite activity.

It was concluded that mite populations can be effectively controlled by the efficient application of both winter and early summer treatments, when DDT cover sprays are employed for codling moth control. Winter oil sprays reduce the overwintering mite populations, while a summer application of hexaethyl tetraphosphate, preferably early in December, prevents survivors of the winter treatment assuming pest proportions before cover spray applications cease.

Woolly Aphis.

This pest was of no importance in Experiment 1 but was prevalent in Experiment 2 early in the season and persisted until summer. Though DDT applications checked the activity of the parasite *Aphelinus mali* in the earlier parts of the season, woolly aphis did not increase in the several plots in conformity with frequency of DDT applications. Differences of infestation in the plots by midsummer

were rather a reflection of the order of severity of infestation that existed in early November. The combined effect of an application of hexaethyl tetraphosphate and increased parasite activity brought the pest under control by mid-January.

The future status of this pest is dependent on several factors, but these trials have shown that populations should be checked as early in the season as practicable, preferably by early summer. The helpful parasite, though present throughout the season, is never sufficiently numerous until mid or late summer to exert much influence on the pest population, and the use of an insecticide to supplement its influence is advisable. The early summer application of hexaethyl tetraphosphate for mite control will also prove beneficial in controlling woolly aphis, provided the spray is applied thoroughly at high pressure.

PRACTICAL APPLICATION OF RESULTS.

Further experimental work to finalise an orchard spraying schedule is planned for the 1949-50 season, but growers may wish to implement some of the suggested alterations to their pest control programme arising from last season's experiments.

These indicate that previously recommended spraying schedules concerning DDT applications may be reduced without prejudicing the control of codling moth and light brown apple moth populations following its use throughout the district.

DDT should be applied to cope with larval populations following peaks of moth activity. Cover sprays 1 and 2, three weeks apart, are sufficient to check the late spring codling moth infestation. These sprays will also serve to arrest early summer light brown apple moth damage.

Midsummer applications of DDT for codling moth control should be dictated by trapping records. Any increase in moth activity during early January should be followed by two applications of 0.1 per cent. DDT three weeks apart. If a definite peak of moth activity has not occurred by mid-January, then, to cover midsummer requirements against both codling moth and the light brown apple moth, these sprays should be applied as a routine measure.

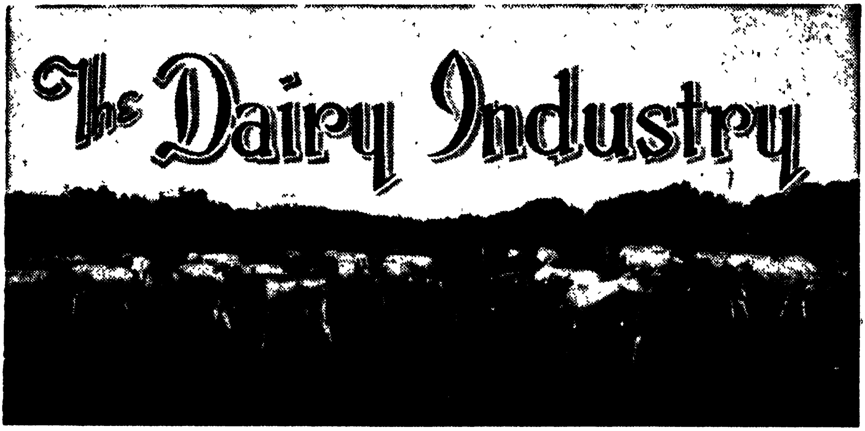
The measures used in the experiments for mite and woolly aphis control—namely, a dormant or semi-dormant oil spray and an early to mid-summer application of hexaethyl tetraphosphate with a thorough wetting of woolly aphis—appeared adequate and should be employed on orchards where DDT is used.

PROTECTION OF BIRD LIFE.

A number of new sanctuary areas under *The Fauna Protection Act of* 1937 have recently been proclaimed and additional honorary protectors appointed.

Within sanctuaries, all native birds and animals, except certain declared pests, are totally protected at all times. It is an offence to shoot fauna for which such protection is provided, whether an open season has been declared or not, as an open season relates only to places outside of sanctuaries.

The Minister for Agriculture and Stock (Hon. H. H. Collins) has appealed to all persons to respect the sanctuaries throughout the State and thus ensure adequate protection for native birds and animals.



Pure Bred Herd Recording, 1948-49.

S. E. PEGG, Senior Adviser (Herd Recording), Division of Dairying.

THE number of pure bred cows submitted for production recording during the year showed a big increase over the number recorded during 1947-48, and owing to staff shortages it was neccessary to reject applications for recording from a number of breeders. Altogether 149 breeders took part in the scheme, the number of owners according to the respective breeds being—A.I.S., 66; Ayrshire, 8; Friesian, 1; Guernsey, 10; Jersey, 64.

Table 1 shows a comparison between the numbers of cows of various breeds which completed lactations during the year and those in the previous year.

TABLE 1.

COWS COMPLETING LACTATIONS IN 1948-49 AND 1947-48.

Number and Percentage of Cows.

Breed.	Total.		Passed.		Failed.		Withdrawn.	
	1947-48.	1948-49.	1947-48.	1948-49.	1947-48.	1948-49.	1947-48.	1948-49.
A.I.S. ..	338	660	156 (46%)	314 (48%)	70 (21%)	140 (21%)	112 (33%)	206 (31%)
Ayrshire	18	43	7 (39%)	15 (35%)	6 (33%)	12 (28%)	5 (28%)	16 (37%)
Friesian	Nil	7	..	3 (43%)	..	..	..	4 (57%)
Guernsey	36	72	16 (44%)	42 (58%)	8 (22%)	12 (17%)	12 (33%)	18 (20%)
Jersey ..	492	645	242 (49%)	385 (60%)	116 (24%)	141 (22%)	134 (27%)	119 (18%)
Total..	884	1,427	421	759	200	305	263	363
Percentage	..	..	48%	53%	23%	21%	30%	25%

It will be noted that 53 per cent. of cows passed the required standards in 1948-49, compared with 48 per cent. in the previous year.

During the year the following production records for a 273-day period were established:—

A.I.S., Junior 3. W. H. Thompson's "Alfa Vale Model 29th"—14,516 lb. milk, 691 lb. butterfat.

Jersey, Senior 4. C. W. & E. M. Barlow's "Wyreena Daisy Belle"—11,397 lb. milk, 599 lb. butterfat.

The average production for each age group of each breed for cows completing lactation during the year is shown in Table 2, from which it will be noted that the average production per cow irrespective of age was 6,783 lb. milk and 323 lb. butterfat, with an average test of 4.75 per cent. as compared with 6,981 lb. milk, 326 lb. butterfat, and an average test of 4.67 per cent. in the previous year.

Table 3 gives the average production for each age group of each breed for the period 1930-1948.

TABLE 2.

BREED PRODUCTION AVERAGES FOR REGISTERED HERD BOOK STOCK WHICH COMPLETED LACTATION RECORDS OF 273 DAYS DURING THE YEAR ENDING 30TH JUNE, 1949.

Breed.	—	J. 2.	S. 2.	J. 3.	S. 3.	J. 4.	S. 4.	M.	All Ages.
A.I.S.	No. of Cows ..	119	80	42	39	29	27	118	454
	Lb. Milk ..	6,717	7,126	7,650	8,161	8,002	9,296	9,322	7,912
	Lb. Butterfat ..	276	284	332	321	323	375	381	323
	Test % ..	4 11	3·98	4·34	3·94	4·03	4·03	4·08	4·08
AYRSHIRE ..	No. of Cows ..	12	..	2	..	2	3	8	27
	Lb. Milk ..	5,867	..	6,916	..	6,002	7,694	7,598	6,673
	Lb. Butterfat ..	250	..	289	..	253	317	314	280
	Test % ..	4·26	..	4 16	..	4 22	4 12	4·12	4·19
FRIESIAN ..	No. of Cows ..	..	..	..	..	1	..	2	3
	Lb. Milk ..	..	..	..	..	10,903	..	13,720	12,781
	Lb. Butterfat ..	..	..	..	..	372	..	460	430
	Test % ..	..	..	..	..	3·4	..	3·35	3 36
GUERNSEY ..	No. of Cows ..	11	11	3	5	4	3	17	54
	Lb. Milk ..	5,438	6,213	6,356	6,205	7,624	7,096	8,274	6,865
	Lb. Butterfat ..	273	292	312	281	343	341	426	334
	Test % ..	5·02	4·7	4·91	4 53	4 5	4·8	5·08	4·85
JERSEY ..	No. of Cows ..	175	72	49	39	22	37	132	526
	Lb. Milk ..	4,075	5,722	6,132	6,794	6,856	7,132	7,054	5,772
	Lb. Butterfat ..	276	297	321	359	358	375	367	323
	Test % ..	6·77	5 19	5 23	5·28	5·21	5 26	5·2	5·58

All Ages and all Breeds:—No. of Cows, 1,064; Milk, 6,783; Fat, 323; Test, 4·75%.

TABLE 3.

BREED PRODUCTION AVERAGES FOR REGISTERED HERD BOOK STOCK WHICH COMPLETED LACTATION RECORDS OF 273 DAYS BETWEEN 1930 AND 1948.

Breed.	—	J. 2.	S. 2.	J. 3.	S. 3.	J. 4.	S. 4.	M.	All Ages.
A.I.S.	No. of Cows ..	1,039	590	389	289	218	202	902	3,629
	Lb. Milk ..	6,807	7,277	7,712	8,622	8,373	8,893	9,706	8,056
	Lb. Butterfat ..	272	294	311	337	339	354	389	323
	Test % ..	4·0	4·04	4·03	3·9	4·05	3·99	4·00	4·0
AYRSHIRE ..	No. of Cows ..	59	30	27	44	12	14	82	268
	Lb. Milk ..	6,128	6,385	7,326	7,671	6,940	8,956	8,067	7,308
	Lb. Butterfat ..	343	255	289	301	284	365	326	292
	Test % ..	3·96	3·98	3·94	3·92	4·09	4·07	4·03	3·99
FRIESIAN ..	No. of Cows ..	39	20	15	6	3	8	23	114
	Lb. Milk ..	7,679	9,000	8,338	9,055	10,016	9,457	12,103	9,235
	Lb. Butterfat ..	295	328	303	330	337	364	435	338
	Test % ..	3·84	3·64	3·67	3·65	3·36	3·85	3·59	3·7
GUERNSEY ..	No. of Cows ..	38	35	27	12	6	5	24	147
	Lb. Milk ..	5,641	6,049	6,684	6,352	7,142	7,150	7,976	6,482
	Lb. Butterfat ..	280	290	334	314	351	369	391	319
	Test % ..	4·96	4·79	5·0	4·94	4·92	5·16	4·91	4·92
JERSEY ..	No. of Cows ..	1,446	460	389	316	245	186	827	3,869
	Lb. Milk ..	4,962	5,492	5,903	6,322	6,526	6,801	6,999	5,853
	Lb. Butterfat ..	265	296	316	338	349	364	370	312
	Test % ..	5·34	5·38	5·36	5·34	5·34	5·35	5·29	5·33
RED POLL ..	No. of Cows ..	3	3	..	..	..	..	6	12
	Lb. Milk ..	5,293	6,122	..	..	..	..	7,373	6,540
	Lb. Butterfat ..	212	244	..	..	..	..	277	252
	Test % ..	3·99	4·0	..	..	..	..	3·75	3·86

A Survey of Herd Wastage and Other Factors on Queensland Dairy Farms.

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DAIRYING in Queensland is spread over a large area of the coastal and sub-coastal parts of the State, with varying environmental conditions, pastures and fodder crops in the different districts. Thus information on dairying practices applicable to one district does not necessarily apply with respect to other districts. This article gives information obtained from a preliminary survey carried out with the co-operation of 122 farmers situated in widely different parts of Queensland in 1947-1948. The farms, which showed considerable variability in herd size, may be taken as representative of small, moderate and large dairy farms in the State. The co-operating farmers furnished a monthly return containing the requisite information for the carrying out of the survey.

From the data available from the survey, information was prepared on the following aspects of herd management:—

(1) Wastage of dairy cattle.

(2) The seasonal incidence of calving.

(3) Calves reared and disposals of surplus calves.

(4) Estimated carrying capacity of farms.

(5) Estimated numbers of female stock kept per bull used.

The distribution of herds, according to districts, was:—

Darling Downs, 22; North Queensland (Atherton Tableland and Daintree), 6; Central Queensland (Rockhampton, Gladstone, Dawson, and Callide Valleys), 21; South-eastern Queensland (Gympie to New South Wales border and inland to the Dividing Range), 34; Central and Upper Burnett (Biggenden, Gayndah and Monto), 29; South Burnett (Nanango, Kingaroy and Murgon), 10.

Herd Wastage.

Wastage in dairy herds is of great importance in dairy farming economy. Wastage is considered here only in relation to the losses of stock from a herd through cullings for diseases, low production, and other factors which affect the economic usefulness of the animal or its productive life; it does not include wastage due to the sale of cows for use as producing units in other herds. It may be pointed out that surveys made in other countries have shown a surprisingly high annual replacement figure in the dairy cattle population of those countries. In various surveys made in different parts of England, the replacement rate in herds has been found to vary from 16 to 25 per cent., and in New Zealand it was ascertained from an extensive investigation carried out among herds which were production-recorded under the grade herd recording scheme that the annual percentage of cullings, &c., from herds was 17 per cent.

The overseas investigations have shown that the principal causes of disposals of cows from dairy herds fall within three major groupings:—

(1) Sales of surplus stock. This is not strictly true wastage.

(2) Low milk yield due to various reasons.

(3) Failure to breed; that is, sterility due to various causes.

These three causes represented about 60 per cent. of the total disposals.

Wastage surveys give useful information which indicates the degree to which various methods of management, feeding and other factors exert an influence on the productive life of dairy cattle, and may aid in formulating control measures. It has to be remembered that before a dairy cow becomes a profitable unit in a herd she has been kept on the farm for about two years. Moreover, her production should steadily increase in each succeeding lactation period until maximum production is reached at about seven years of age, after which there is a gradual decline in the following years. It is obvious from the wastage data previously referred to that many cows are culled before maturity and hence before having attained maximum production. Clearly, serious economic losses must result if cows have to be culled even before reaching full production. After all, the economic cow is one which gives a good yearly production of milk or butterfat over a long number of years.

Table 1 sets out the total wastage of stock in the herds included in this survey.

TABLE 1.

HERD WASTAGE.

—	All Qld.	Downs.	N.Q	C Q.	S E.Q.	C. and U. Burnett.	South Burnett.
Percentage of wastage including cattle sold for dairy purposes	19·6	17·9	24·9	22·1	18·1	22·3	9·5
Percentage of wastage excluding cattle sold for dairy purposes	13·1	10·1	14·4	16·5	14·5	12·9	8·1

It will be noted that cattle sold for dairy purposes constituted nearly one-third of the disposals. Omitting such sales, as cattle sold for dairy purposes are not lost to the industry, the true wastage, which was 13.1 per cent. for the whole State, is reasonably low in comparison with the results shown in similar surveys in other countries. The average life of a dairy cow in Queensland is thus calculated as 7.7 years; or, in other words, the average dairy cow in Queensland completes five lactation periods.

In Table 2 the wastage, excluding cattle sold for dairy purposes, is presented according to the various causes for culling of cows from the herds.

TABLE 2.

VARIOUS CAUSES OF WASTAGE, SHOWN AS PERCENTAGES OF TOTAL WASTAGE.

—	All Qld.	Downs.	N.Q.	C.Q.	S.E.Q.	C. and U. Burnett.	South Burnett.
Low Production ..	17	25	28	18	14	13	14
Aged	24	10	14	35	19	33	25
Udder Troubles ..	18	15	27	3	29	15	25
Brucellosis ..	7	23	5	4	2	2	..
Sterility	4	4	2	4	7	2	4
Calving Troubles	3	4	2	3	3	1	7
Tuberculosis ..	2	1	..	9	..	1	2
Accidents	4	4	5	4	4	2	5
Killed by Dingoes	1	1	1	3	1	1	..
Tick Fever ..	2	..	..	2	2	5	..
Other known Causes	10	6	4	11	9	16	13
Unknown	8	6	11	4	9	9	5

A perusal of the table reveals that low production, old age and udder troubles, which between them accounted for almost 60 per cent. of cullings, are the main causes of wastage of cows from Queensland dairy herds.

Some comment is necessary on the individual causes of wastage in certain districts. The high rate of culling for udder troubles in south-eastern and North Queensland was accounted for by the relatively high proportion of herds in these districts on farms supplying milk for market milk purposes; frequent laboratory testing of samples of milk in connection with the Milk Quality Control Scheme has led to an intensive check of herds on milk-supply farms for the purpose of excluding milk from cows affected with mastitis. The high percentage of cullings for tuberculosis in Central Queensland was due to the disposal of reactors in some of the herds included in the surveys. The apparently higher incidence of brucellosis, or contagious abortion, on the Darling Downs is difficult to understand, but is probably due to a greater amount of testing for this disease in this area.

Seasonal Incidence of Calving.

Investigations carried out in other countries have shown that there is an optimum time for calving, which is usually just before pastures commence their new seasonal growth. Cows calving at this time attain their maximum production when the pastures are in full growth, which ensures most efficient use of the pasture, the cheapest food for cows. In a recent investigation in Queensland (see this Journal for March, 1948), it was found that the average production of cows calving in the late winter and early spring (July to September, inclusive) was 30 lb. of butterfat per lactation above that of cows which calved between January and March.

The peak period of calvings is seen to be from October to January, inclusive, when 45 per cent. of the calvings occurred. Only 22 per cent. of the cows calved during July to September, the best period from the viewpoint of production in the ensuing lactation period. It should be pointed out, however, that the results for the survey year may not be truly representative of the normal monthly incidence of calvings among dairy herds in Queensland, as the calving times in a high proportion of

herds may have been delayed in 1947-1948 because of the serious setback suffered in the severe drought conditions of 1946-1947; dairy production in that year was slightly less than 50 per cent. of that of the record production year, 1938-1939.

The monthly incidence of calving is tabulated in Table 3.

TABLE 3.

PERCENTAGES OF CALVINGS IN EACH MONTH.

Month.	All Qld.	Downs.	N.Q.	C Q	S.E.Q.	C and U. Burnett.	South Burnett.
July	7	9	6	6	9	4	10
August	7	8	4	7	10	3	7
September	8	9	8	7	10	7	8
October	10	8	6	13	10	10	8
November	12	10	10	13	14	13	11
December	13	11	8	11	11	19	11
January	10	9	7	9	10	13	11
February	7	9	9	7	5	8	6
March	8	8	11	9	6	8	7
April	6	9	10	6	5	6	7
May	6	5	10	6	5	4	8
June	6	6	11	6	5	5	5
No. of Calvings	6,120	1,191	307	979	1,637	1,516	490

Calves Reared and Disposal of Surplus Calves

Table 4 indicates the relative proportions of male and female calves born in the herds, and the percentages of female and male calves kept for rearing.

TABLE 4.

PERCENTAGES OF MALES AND FEMALES AND PERCENTAGES OF CALVES REARED.

—	All Qld.	Downs.	N.Q.	C Q	S E.Q.	C and U. Burnett.	South Burnett.
Heifers born	48·1	48·7	42·3	46·3	48·0	49·8	48·8
Bulls born	51·9	51·3	57·7	53·7	52·0	50·2	51·2
Heifers reared	70·5	69·4	64·8	77·2	67·4	79·5	43·1
Bulls reared	26·2	29·8	8·5	14·9	10·4	21·4	6·0

It is interesting to note that on a State-wide basis 70 per cent. of heifer calves were retained, and that, except for the South Burnett district, there was no marked variation from the mean in the various districts. This dispels any fear that insufficient calves are being reared on dairy farms for normal herd replacements.

The manner in which calves not kept for rearing were disposed of is shown in Table 5.

TABLE 5.

DISPOSALS OF CALVES NOT REARED, SHOWN AS PERCENTAGES OF ALL CALVES BORN.

—	All Qld.	Downs.	N.Q.	C.Q.	S.E.Q.	C. and U. Burnett.	South Burnett.
Sold (bobby calves)	32·0	35·0	26·0	27·0	25·0	34·0	62·0
Slaughtered	23·0	13·0	40·0	28·0	35·0	14·0	12·0
Died	1·5	2·3	1·9	1·1	1·2	1·3	1·2
Stillborn	·6	·4	·3	·2	·8	·4	·6

Stock Carrying Capacity of Farms.

An assessment was made of the numbers of acres required to maintain each head of dairy cattle according to district. This information is shown in Table 6.

TABLE 6.

ACRES PER HEAD OF DAIRY CATTLE.

District.	Average.	Range.
All Queensland	5·3	1·3 to 21·0
Darling Downs	6·6	3·3 to 11·4
North Queensland	2·5	2·0 to 3·5
Central Queensland	6·9	3·1 to 12·6
South-eastern Queensland	2·9	1·3 to 5·7
Central and Upper Burnett	7·0	2·0 to 21·0
South Burnett	4·4	2·4 to 7·3

Allowance has not been made for any portion of the farm used for the cultivation of cash crops, or other purposes than dairy cattle, which is quite appreciable in most dairying districts in Queensland, where dairying is so frequently associated with mixed farming. Because of the comparatively low number of farms in each district, the information given in this table is approximate only and, further, the stock-carrying capacity also varies widely even among farms in each sub-district.

Cows and Heifers per Bull.

Table 7 indicates the number of cows and heifers kept per bull. It is of interest to note the similarity of the figure in all districts.

TABLE 7.

NUMBER OF COWS AND HEIFERS PER BULL.

All Queensland	40
Darling Downs	38
North Queensland	29
Central Queensland	40
South-eastern Queensland	40
Central and Upper Burnett	46
South Burnett	40

With the rapid expansion of herd recording in Queensland, larger numbers of farms should be available for providing data for future surveys of this kind, but the information derived from the present survey should be of interest and value to the industry in focussing attention on some important aspects of dairy farming economy.

MORE HELP TO PIG RAISERS.

The Department of Agriculture and Stock plans to extend its advisory services to pig producers by placing an Adviser at Biloela early in the New Year. In announcing this, the Minister for Agriculture and Stock (Hon. H. H. Collins) said that the East Moreton, Darling Downs, South Burnett and Atherton Tableland areas already had district advisory officers, who were giving valuable aid to producers on problems of management, feeding and housing.

The new district would cover the important Rockhampton-Callide-Dawson Valley areas.

Feeding Dairy Cows in Spring.

ON the cover of this issue and below are pictures of sowings of skinless barley and Dun field peas made from April to July by Mr. H. Sinnamon on his farm at 17-mile Rocks on the Brisbane River. The value of a succession of sowings is evident from Plate 138, in which are shown, in the distance, the early planting being harvested for feeding to cows and, nearer the camera, patches in various stages of development. This land has been farmed for nearly 70 years.

Plate 137.

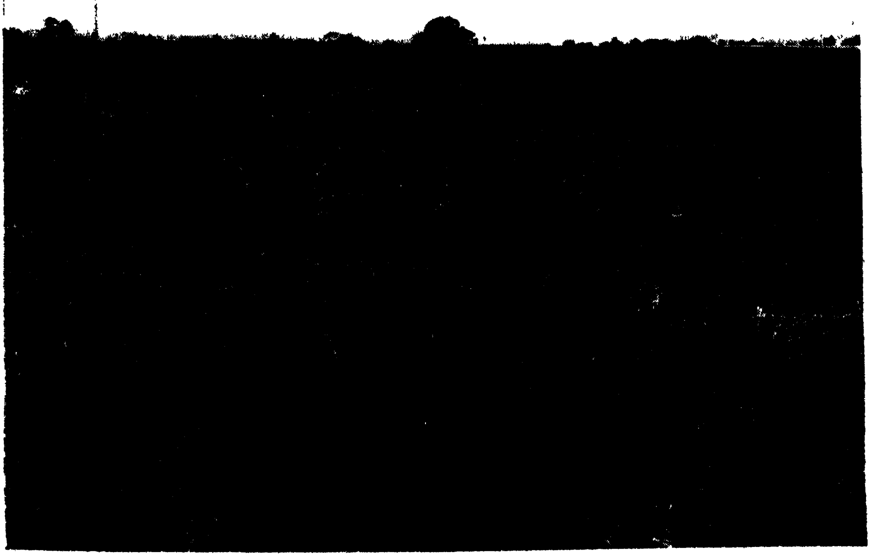

Plate 138.

Pulpy Kidney (Entero-toxaemia) of Sheep.

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PULPY kidney is a disease of sheep which is well known in the southern States of Australia, where it has been responsible for serious losses amongst both Merinos and crossbreds. Recently, however, it was diagnosed as the cause of mortality of fat lambs on the Darling Downs, and although there is nothing to suggest that it is a common disease in this State, sheep men would be well advised to seek the opinion of Departmental officers on any unusual deaths among their flocks.

The Cause of Pulpy Kidney.

The name entero-toxaemia which is often given to this disease indicates that it is a general poisoning of the system by a toxin formed in the bowel. It is an acute disease caused by a minute organism which is common in the soil and which, on being swallowed with the food, establishes itself in the bowel. In certain circumstances, all of which are not well understood, it forms a very potent poison which is absorbed into the blood stream and brings about very rapid death. In lambs, one of the most characteristic post-mortem findings is decomposition of the kidneys, which are typically dark and bruised in appearance and soon become pulpy.

The disease occurs most commonly in "flush" seasons and amongst sheep which are in prime condition. Accordingly, it is considered that the state of the digestive tract is an important contributing factor to the formation of the poison which is so highly fatal to sheep. However, the disease may occur amongst sheep which are depastured on dry feed and it has been reported from north-western New South Wales amongst Merinos grazing on dry Mitchell grass.

Pulpy kidney tends to be seasonal in nature and is seen most commonly among lambs grazing on winter cereal crops and amongst grass-fed animals in the spring.

Symptoms and Post-Mortem Findings.

The course of the disease is very rapid, death resulting in a few hours. Very few symptoms are noticed when Merinos in pastoral areas are affected: the animals are just found dead. When an outbreak occurs amongst lambs it is usually the fattest and most forward animals which are affected. Sometimes symptoms of giddiness and uncertainty

of gait are observed, but the animal soon goes down. Death may be uneventful, but in most cases it is rapid. Sometimes the lambs die in the "sleeping position"; sometimes there is struggling and frothing at the mouth. There may be some scouring shortly before death, with the faeces creamy in colour.

There are practically no unusual post-mortem findings if the examination is made immediately after death.

There may be engorgement of the blood vessels supplying the bowel, excessive fluid in the heart sac, and a few small blood spots on the inner and outer surface of the heart walls.

The carcase decomposes rapidly and a few hours after death the kidneys of lambs may be so soft that it is impossible to remove them intact from the carcase. In addition, there may be congestion of the lungs and gas formation in the bowel. The small intestines contain very little solid material and they are easily broken.

Diagnosis of Pulpy Kidney.

It is often difficult to diagnose the disease in the field. A history of losses from no other apparent cause is suggestive, but the age and condition of the sheep and the time when mortalities occur have to be considered. A definite laboratory diagnosis can only be made by examining specimens taken from lambs immediately after death, and in this regard sheep raisers would be well advised to seek the assistance of Departmental officers.

Prevention and Control.

When an outbreak occurs all dead sheep should be burnt to destroy the organism present in the intestine and the surviving animals should be fed a more fibrous ration. It may be necessary to feed cereal hay or chaff to introduce more fibrous bulk into the ration of lambs grazing succulent crops. Alternatively, the sheep may be given free access to pasture paddocks as well as to the grazing crops. Yarding for a few hours each day may be helpful in preventing losses. Trouble usually ceases in lambs as the result of the setback they receive at marking.

Entero-toxaemia in adult sheep is easily controlled by vaccination, and on properties on which trouble occurs frequently it is advisable to vaccinate the lambs at marking time. If losses are occurring prior to marking, it is advisable to vaccinate the ewes prior to lambing. Some of the immunity developed in the ewe is passed on to her lamb and will serve to protect it for the first month of its life. If it is desired to use this method, and the ewes have not been vaccinated previously, it is necessary to give them two injections, the second being made within about two weeks of lambing.

GRAINS AND SEEDS FOR WESTERN AUSTRALIA.

Grain and seeds of a number of Queensland crops will need to be accompanied by a special certificate from the Queensland Department of Agriculture and Stock before they will be admitted to Western Australia.

Maize, sunflower, sorghums, Sudan grass, millets, cowpeas and peanuts must be certified free of Bathurst burr, Noogoora burr, mint weed and thorn apple (datura) before export to the west. Properly drawn samples should be submitted to the Standards Officer of the Department of Agriculture and Stock for examination.

Spaying of Cattle.

PREPARED IN THE DIVISION OF ANIMAL INDUSTRY.

THE practice of spaying female cattle is adopted as a method of culling inferior or cast-for-age cows from the breeding herd. Though it is at present more or less confined to beef animals, spaying as a means of disposing of the unprofitable cows in dairy herds for butchering is worthy of consideration.

The operation may be carried out on females of all ages from five months. It may be performed at any time of the year, but it is preferable to limit spaying by the flank method to the cooler months and when pastures are adequate.

ESSENTIALS IN SPAYING.

Irrespective of the age at which spaying is carried out and of the method used, the following fundamental requirements should be observed:—

(1) Feed and water should be withheld from the cows for at least 12 hours and preferably 24 hours before the operation, in order to ensure that the beasts are empty.

(2) The animals must be kept quiet and cool.

(3) It is advisable to avoid spaying when animals are pregnant or in a feverish condition.

(4) Spaying should not be carried out under dirty conditions.

(5) The animals must be held under adequate restraint.

(6) The instruments must be in good order and sterilized.

(7) The operation should be performed neatly and completely. Excessive speed is the cause of many failures.

(8) The animals should be kept as quiet as possible for at least 10 days after spaying.

METHODS OF SPAYING.

Spaying may be effected by three methods:—

(1) Through the ventral (lower) surface of the abdomen.

(2) Through the vagina or female passage.

(3) Through the flank.

Spaying Through the Abdomen.

This method is the best to use for calves and small and young heifers.

Equipment Required.

Clippers or pair of curved scissors; sharp knife; spaying emasculator or ecraseur; several strong curved needles; strong suture thread; hoist and gambrel.

With this method, as with the others described later, the instruments should be sterilized by boiling in water for at least 10 minutes, and such sterilization repeated from time to time. To keep the instruments reasonably safe while in use, they should be put into 5 per cent. "Dettol" or some other reliable antiseptic solution. The operator's hands should likewise be kept clean by washing in the solution.

Method of Operating.

The animal is roped, taken close to the hoist, thrown, and the hind legs placed separately in the two loops formed by the rope passing through the holes in the gambrel. The main hoisting rope is now pulled (which tightens the rope around the pasterns) and the animal's hindquarters raised off the ground, leaving the shoulders, neck and head, however, still on the ground so that they may be held by an assistant. Another assistant clips off the hair over an area of about a few square inches just in front of the teats and in the middle line. The clipped area is cleaned with methylated spirits, and tincture of iodine applied.

The operator now makes an incision about 1 inch long in the middle line just in front of the front teats and right through into the abdominal cavity. Two fingers are then inserted; one horn of the uterus is grasped, drawn out until the ovary is exposed, the ovary removed with the emasculator, and the horn of the uterus replaced. The other horn is picked up in a similar manner, the ovary removed, and the horn replaced. Two or three interrupted stitches close up the wound, which is smeared over with some reliable antiseptic dressing. The main hoisting rope is released, the gambrel coming down, the loops of rope are removed over the feet, and the animal is at once released.

Beyond removal to a paddock close by, no further attention is required.

Passage Spaying.

This method of spaying is the one generally adopted for cows and is preferable to the flank method. With heifers, however, the vagina is too small to admit the hand and instruments.

The operation is performed in the standing position. Any of the following methods of restraint can be used:—

(1) Placing the cow in an ordinary dairy bail.

(2) Placing a rope around the cow's horns and pulling her up to a fence.

(3) Placing the cow in an ordinary cattle crush, the animal's head being tied securely by a rope around the horns.

(4) Placing the cow in a specially constructed cattle crush, such as can be seen on any cattle run where spaying of cows is extensively carried out. This type of crush is so constructed that the cow's head is held firmly in a special bail, and while there is little lateral movement the operator has ample room for working.

Equipment Required.

Spaying emasculator or ecraseur;
Special spaying knife;
Depressor.

As previously mentioned, the instruments must be well sterilized in boiling water, a liberal supply of which should always be available, as well as clean cold water. A quantity of 5 per cent. solution of lysol or phenol solution should be on hand in which to keep the instruments while operating.

The animal in position, an examination is made, especially wi'' dairy cows, to ascertain if there is any discharge from the uterus or any signs of acute vaginitis. Should the vaginal cavity be normal, it is advisable not to douche it out; if, on the other hand, it is abnormal, involving either of the above conditions, it is advisable to put off the operation until some future date, placing the animal under a course of treatment. When this is not possible, the vaginal cavity should be well douched out with a weak disinfectant solution before operating.

Method of Operating.

An assistant takes the cow's tail and washes around the anus, vulva and buttocks with a 5 per cent. antiseptic solution. The operator, having washed his hands and arms in a 2 per cent. disinfectant solution, passes the left hand into the vaginal cavity. The depressor, held in the right hand, is passed into the vaginal cavity along the left arm, the ring being placed on the mouth of the womb, with the convex surface of the curve upwards. Pressure is applied and the vaginal wall made firm. The left hand is withdrawn and takes the depressor, pushing it firmly forward, while the right hand with the spaying knife is introduced into the vaginal cavity. The blade is thrust through the wall by a sudden stab, an incision about 1 inch being made about 2 or 3 inches above the mouth of the womb. Both t' wall of the vagina and the peritoneum must be cut, otherwise the operator will not be able to reach the ovaries.

The incision being completed, the knife and depressor are withdrawn. Two fingers of the left hand are inserted into the incision, forced through into the abdominal cavity, and one ovary seized. This is withdrawn through the opening and placed through the jaws of the spaying emasculator, which has been introduced with the right hand. The attachment of the ovary is now crushed and the ovary placed on the floor of the vagina. The two fingers of the right hand are again inserted into the abdominal cavity and the other ovary seized and crushed off in the same way. Both ovaries are now withdrawn, together with the emasculator, and the operation is complete.

No special after-care is required, but spayed animals should be allowed to rest as much as possible for at least 10 days. If properly performed, under clean conditions, the loss is nil. Complications such as haemorrhage and septic peritonitis are, however, possible. Bloating may also be seen occasionally after spaying, but this is not serious and soon disappears.

Flank Spaying.

While this is the oldest, it is also the easiest method of spaying and is the one generally adopted with heifers. Many cows are also spayed by this method, but passage spaying is preferable for them.

The standing position is to be preferred and should always be adopted where suitable yards and crushes are available. Such a crush is so devised that the animal can be held between a pair of gates so that the movement of the body is reduced to a minimum. In one of these gates, nearly always the left hand one, there is a trap gate large enough to allow the operator to work on the site of the operation. Rails are placed under the brisket and abdomen to prevent the animal going down while operating. By this method, where there is more than one set of gates, large numbers of heifers can be spayed quickly. There are many different types of these crushes, but they have the one objective, namely, keeping the animal's body as still as possible.

Spaying may be carried out with the animal thrown and stretched out on the ground in a position similar to that used for branding. The method of operating is as described for the standing position, but as the recumbent method of restraint has nothing to recommend it, it is very seldom adopted.

Equipment Required.

The equipment required for this operation consists of:—

Sharp knife;	Artery forceps—optional;
Spaying emasculator;	Needle forceps—optional;
Reel of strong cord;	Several good, sharp, strong, slightly curved needles.
Pair of clippers;	

Have also on hand tincture of iodine, a good supply of 5 per cent. disinfectant solution, soap and towel. All instruments must, of course, be well sterilized by boiling and be reboiled from time to time and kept in a strong disinfectant solution while in use.

The Site of Operation.

The operation may be performed on either side, but the left side is most frequently selected. On this left side there is only the rumen, while on the right there is a mass of bowel. Whatever side is selected the site of the operation is always the same, namely, that portion of the side of the abdominal wall midway between the last rib and the prominent bone commonly known as the hip bone.

Method of Operating.

Clip the hair off the site of operation; rub well with strong antiseptic solution, and dry and paint the area with tincture of iodine. An incision about 3 to 4 inches long is made in a downward direction through the skin, midway between the last rib and the hip bone. The fibres of the outer muscle are noted running downwards and backwards. These are divided either with the scalpel or the fingers, the incision preferably made with the scalpel, and then enlarged along the direction of muscle fibres with the fingers. Those fibres of the next muscle are now exposed and these are likewise incised in the opposite direction. The peritoneum or inner layer is now exposed, punctured with the scalpel and then enlarged by tearing, exposing the rumen.

The operator, standing with his back to the animal's head, inserts the left hand through the incision backwards and downwards over the rumen to that point where the brim of the pelvis turns upwards. Here the right ovary can be felt hanging from its appendages. It is

usually about the size of an almond nut in heifers and larger in cows, when normal; however, if it is cystic it may be much larger. The ovary is seized between two fingers and placed between the jaws of the emasculator, which is inserted by the right hand along the left arm. This ovary having been detached from its appendages, the left hand is either withdrawn to drop the ovary outside or placed across and takes up the left ovary, which is likewise placed between the jaws of the emasculator and cut off. The emasculator and ovaries are now withdrawn. If the ovary is not withdrawn care must be taken not to drop it within the abdominal cavity as it may graft onto the peritoneum.

The wound of the skin is closed with a few interrupted stitches; no muscles stitches are required. Beyond applying some reliable antiseptic dressing, no further treatment is required. Some operators recommend removal of the stitches in about 12 days, but this is not necessary unless, of course, some complications have developed. These may be septic peritonitis, haemorrhage or local abscesses.

WARNING ON THE USE OF SODIUM FLUORIDE.

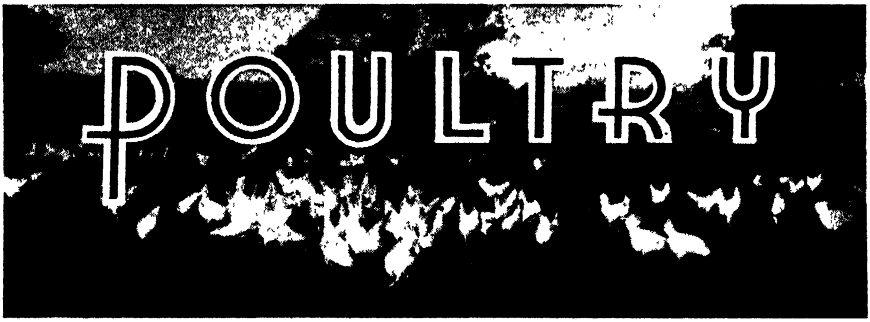
The Veterinary Services Branch of the Department of Agriculture and Stock advises pig farmers not to give sodium fluoride to pigs in liquid form.

This new remedy for worms has given excellent results when mixed with ground grain or ready mixed mashes, as this allows the medicine to be slowly absorbed by the animal. A case has recently come under notice where a Darling Downs farmer fed sodium fluoride to his pigs in diluted molasses. This method of giving the medicine resulted in a very quick uptake of the chemical and several pigs were lost through poisoning.

The use of sodium fluoride is very effective and quite safe if the sodium fluoride is incorporated in dry feed equivalent to a full day's ration computed on the basis of 1 lb. of dry feed to each 25 lb. liveweight of pig.

TUBERCULOSIS-FREE CATTLE HERDS (AS AT 1st NOVEMBER, 1949).

Breed.	Owner's Name and Address of Stud.
Aberdeen Angus	The Scottish Australian Company Ltd., Texas Station, Texas.



Breeds of Fowls.

P. RUMBALL, Officer in Charge, Poultry Branch.

(*Continued from page* 306 *of the November issue.*)

STANDARDS.

IN order to maintain breed characteristics it is essential to have standards to which to breed. Thousands of fowls are bred yearly by producers with little or no consideration being given to type. The departure from type may be attributed in some degree to the exaggerated specimens at times seen on the show bench, and to greater consideration being given by judges to feather markings than to types and egg-producing qualities.

From the one breed in many instances there have been developed two types; namely, the standard-bred fowl and the utility-bred fowl. In trying to perfect his bird from a show point of view the fancier sacrificed egg qualities, while the egg producer in the race to produce eggs sacrificed type. The egg producer sacrificed type to such an extent that commercial breeders years ago drew up a utility poultry standard to be read in conjunction with the standard of perfection as laid down by the Poultry Club of England.

This move has proved of great advantage to the industry, since the improvement in type that has taken place has materially assisted in maintaining the health and stamina of our flocks.

LEGHORNS (Plates 139 and 140).

General Characteristics.

THE COCK.

Head.—Skull fine. Beak stout, the point clear of the front of the comb. Eyes prominent. Comb (*a*) single or (*b*) rose: (*a*) perfectly straight and erect, large but not overgrown, deeply and evenly serrated (the spikes broad at their base), extending well beyond the back of the head and following, without touching, the line of the head, free from "thumb marks" or side spikes; (*b*) moderately large, firm (not overgrown so as to obstruct the sight), the leader extending straight out behind and not following the line of the head, the top covered with small coral-like points of even height, and free from hollows. Face smooth. Ear-lobes well developed and rather pendant, equally matched in size and shape, smooth, open, and free from folds. Wattles long and thin.

Neck long, profusely covered with hackle feathers.

Body wedge-shaped, wide at the shoulders and narrowing slightly to root of tail; round and prominent breast; long back sloping slightly to the tail; large wings tightly carried and well tucked up; moderately full tail at an angle of 45 degrees from the line of the back.

Legs moderately long. Shanks fine and round (flat shins objectionable) and free of feathers. Toes (four) long, straight, and well spread.

Carriage very sprightly and alert. There should be no suggestion of stiltiness.

Plumage of silky texture, free from woolliness or excessive feather.

Handling, firm with abundance of muscle.

Weight not less than 6 lb.

Plate 139.
WHITE LEGHORNS.

THE HEN.

With the exception of the comb (in the single-combed varieties falling gracefully over either side of the face without obstructing the eyesight) and the tail (carried closely and not at such a high angle), the general characteristics are similar to those of the cock, allowing for the natural and sexual differences. Weight not less than 5 lb.

Colour.

Beak yellow or horn. Eyes red. Comb, face, and wattles bright red. Ear-lobes pure opaque white (resembling white kid) or cream, the former preferred. Legs and feet yellow or orange.

THE BLACK.

Plumage.—Rich green-black or blue-black, the former preferred, and perfectly free of any other colour.

THE BROWN.

Plumage of the Cock.—Neck-hackle rich orange-red, striped with black, crimson-red at the front below his wattles. Back, shoulder-coverts, and wing-bow deep crimson-red or maroon. Wing-coverts steel-blue with green reflections forming a broad bar across; primaries brown; secondaries deep bay on the outer web (all that appears when the wing is closed) and black on the inner. Saddle rich orange-red with or without a few black stripes. Breast and under-parts glossy black, quite free from brown splashes. Tail black glossed with green; any white in tail is very objectionable. Tail-coverts black edged with brown.

Plumage of the Hen.—Hackle rich golden-yellow, broadly striped with black. Breast salmon-red, running into maroon around the head and wattles, and ash-grey at the thighs. Body colour rich brown, very closely and evenly pencilled with black, the feathers free from light shafts, and the wings free from any red tinge. Tail black, outer feathers pencilled with brown.

THE WHITE.

Plumage.—Pure white free from straw tinge.

Scale of Points.

THE BLACK.

Head (comb 12, lobes 15)	27
Colour	25
Type	15
Size	15
Condition	10
Legs	8
	100

THE BROWN.

Head (comb 12, lobes 16)	28
Colour	20
Type	15
Size	15
Condition	12
Hackle	10
	100

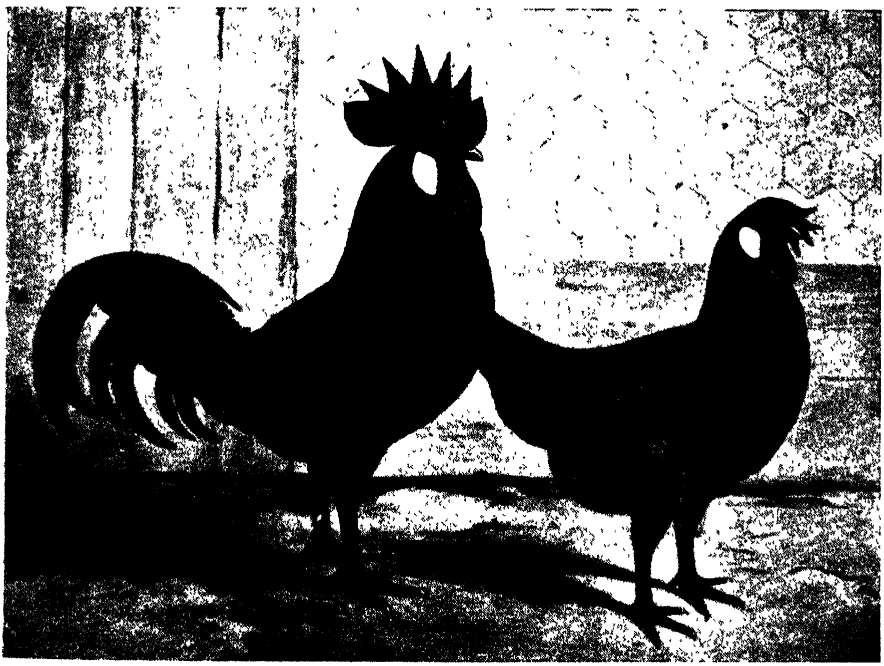


Plate 140.

BROWN LEGHORNS.

THE WHITE.

Type	25
Head (comb 10, lobes 10)	20
Colour	20
Size	15
Condition	10
Legs	10
	100

Serious Defects.—Cock's comb (single) twisted or falling over, or hen's comb erect; rose comb such as to obstruct the sight; ear-lobe red; any white in face; legs other than yellow or orange; wry or squirrel tail; any bodily deformity. In blacks, dark legs or eyes. In browns, white feathers.

As far as is known, the leghorn originally came from Italy, its name being derived from a town in that country. The characteristics of the present-day Leghorn have been largely fixed by American and English breeders as a result of most careful selection over a long period of years.

There are many varieties of Leghorns, e.g., White, Brown, Black, Buffs, Pile, Blue, Exchequer, Cuckoo, Duckwing (silver and gold), and Mottled.

The Leghorn, more particularly the White Leghorn, is possibly the most popular breed or variety of fowl in the world; it has maintained this position for at least half a century, and has done so principally due to its prolificacy. Other characteristics of the breed are that it comes into production early in life, and is most active and alert.

Although there are a large number of varieties of Leghorns, the White stands supreme in the commercial poultry world, followed in order by the Brown and the Black.

The table quality of the flesh of this breed is not considered equal to that of heavy breeds, although young cockerels meet a fair demand.

With regard to size, there are two extremes which are likely to occur when breeding either for exhibition or for egg production. When breeding for the former, the general tendency is to increase the size of the breed. This does just as much harm to the Leghorn as breeding from undersized birds by the commercial poultry farmer striving for egg production. These factors should not be lost sight of when selecting the breeding pen. Under these circumstances, it is advisable to always bear in mind the standard weights as laid down and be just as harsh with a bird that is overweight as with one that is underweight.

Varieties.

The White.—Possibly this variety will always remain supreme in the Leghorn family because of the ease with which it can be bred for egg production and also for exhibition. When selecting birds for breeding, the individual birds should be balanced up by first giving consideration to type, avoiding any exaggerated characteristics. When the actual egg production is known, there is a general tendency to breed from high producers, irrespective of body conformation. This situation is possibly more common among White Leghorns than among all other fowls, as a greater number are tested for egg production.

The Brown.—This variety is difficult to breed true to type and colour. Its popularity has declined of recent years, but some commercial poultry farmers continue with the breed and claim that the hens are equal to White Leghorns as layers.

To produce exhibition cockerels it is necessary to mate an exhibition male with a female that is much too dark for exhibition purposes. To breed exhibition females, matings have to be reversed, mating together an exhibition female and a male very light in colour.

It is generally recognised among the poultry fanciers that the exhibition female line are indifferent layers, whilst the females of the exhibition cockerel line are quite good layers. As a commercial proposition the latter could be fostered.

Another fault which is fairly common in Leghorns, but possibly more pronounced in Brown Leghorns, is the eye colour, or the colour of the iris. It should be red, but there is a tendency towards straw colour, and even green. The latter is a very serious fault, because of the associated tendency towards shortsightedness or blindness. Birds that are short-sighted cannot be profitable and this loss of eye-colour might be associated with leucosis.

The Black.—The Black Leghorn is a good layer, but difficult to breed true to colour. Some breeders resort to double matings for exhibition purposes, but good laying strains could hardly be built up upon this principle. Birds with a good green sheen, free from purple and white in undercolour, should be selected for breeding purposes. White in undercolour is a serious defect which increases with age. Cock birds, sound in undercolour, are particularly valuable. White in wings of young stock is not uncommon, but disappears with the growth of adult plumage.

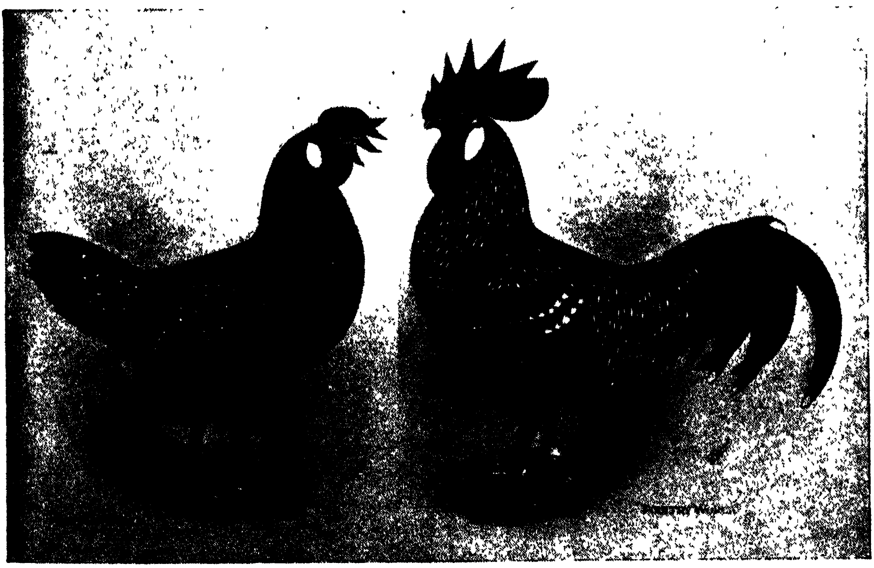


Plate 141.

THE ANCONA.

ANCONAS (Plate 141).

General Characteristics.

THE COCK.

Head.—Skull moderately long, deep, and inclined to width. Beak of medium length and moderate curve. Eyes prominent. Comb (*a*) single or (*b*) rose: (*a*) upright, of medium size, with deep serrations and five to seven spikes (broad at their base), the outline forming a regular convex curve, the back following the line of the head, free from "thumb marks" or side spikes; (*b*) medium size, low and

square front, tapering towards the leader (which should follow the curve of the neck and not be straight out or upwards), the top covered with small coral-like points of even height, and free from hollows. Face smooth. Ear-lobes inclined to almond shape, of medium size, and free from folds. Wattles long and fine.

Neck.—Long, profusely covered with hackle.

Body.—Moderately long, with close and compact plumage, broad front, slightly narrow saddle; full broad breast carried upwards; large wings well tucked up; full tail carried well out.

Legs.—Moderately long. Thighs well apart and almost hidden by the body feathering. Shanks and feet free from feathers. Toes (four) rather long and thin, well spread.

Carriage.—Upright, bold, and active.

Weight.—6 lb. to 6½ lb.; cockerels, 5½ lb.

THE HEN.

With the exception of the single comb, which falls, without obscuring the vision, on one side of the face, the general characteristics are similar to those of the cock, allowing for the natural sexual differences. Weight, 5 lb. to 5½ lb.; pullet, 4½ lb.

Colour.

Beak yellow, shaded with black or horn, preferably not wholly yellow. Eyes orange-red with hazel pupil. Comb, face, and wattles bright red, the face free from white. Ear-lobes white. Legs and feet yellow mottled with black.

Plumage beetle-green with white tippings (the latter free from black or grey streaks), the more evenly V-tipped throughout with white the better, but tipped and not laced or splashed. Under-colour black. All the feathers should be black to the roots, with beetle-green surface, and only the tips white.

Scale of Points.

Colour and markings: purity of white, quality and evenness of tipping, 20; beetle-green ground colour, dark to skin, 15	35
Head (comb 10, eyes 5, beak 5, lobes 5)	25
Type and carriage	15
Texture, general	10
Legs, colour	5
Condition	5
Size	5
	100

Serious Defects.—White in face; white or light under-colour; plumage other than black and white; any deformity.

This breed is believed to have originated in Ancona, in Italy.

They are extremely hardy, quick growers, great foragers, and layers of white-shelled eggs. A notable feature of the Ancona is its highly nervous temperament. It is a very handsome, interesting breed, that will more than pay its way commercially. As a table fowl the Ancona is equal to the Leghorn in quality of flesh.

As regards type, they somewhat resemble the Leghorn, though smaller and lower set, being shorter in thigh. The back is somewhat shorter and not so straight, whilst a characteristic feature of the breed is that the fulness of breast is carried higher than in the Leghorn.

The colour is not just black and white splashes, but calls for white tipping on a black background. The standard calls for feathers to be "V" tipped, but the size of the "V" is not defined. This leaves much to the discretion of the breeder. Tipping should be clearly defined without being splashed with black or grey. White flights are fairly common, and very difficult to breed out when aiming at obtaining correctly tipped birds, and due allowance can be made for such a fault.

Light undercolour is a fairly common fault; it is classified as a serious defect and must be considered as such. Undercolour should be dark right to the skin. The ideal leg colour is yellow mottled with black. Look for definite black mottled (or spots), not patches of black shading; yellow must predominate (yellow mottled with black).

In breeding it is better to use a male with clean yellow legs than one in which the black predominates; the latter will tend to produce a preponderance of black legged females.

MINORCAS (Non-sitters).

General Characteristics.

THE COCK.

Head.—Skull sufficiently long and broad to provide a substantial foundation for the comb. Beak stout, fairly long. Eyes full, bright, and expressive. Comb (*a*) single or (*b*) rose: (*a*) medium size, perfectly straight, upright and rigid, not extending over the point of the beak, the back following without touching the line of the neck-hackle, nicely arched, and evenly serrated with preferably five wedge-shaped spikes, free from "thumb marks" or side sprigs; (*b*) medium size, firm, low, and square front, oblong shape, tapering towards the leader (which should follow the curve of the neck and not be straight out or upwards), the top covered with small coral-like points of even height, free from hollows. Face smooth, the skin taut (wrinkles objectionable), as free as possible from feathers or hairs. Ear-lobes almond-shaped, medium size, widest part on the top, more elongated than round, of kid-like texture, flat and of firm substance, fitting closely to the head and not extending over the face, and without any tendency to hollowness, slackness, or roundness. Wattles long, of oval shape, and fine texture.

Neck.—Long, hackle extending well down to body.

Body.—Broad-shouldered, fairly long, and compact with a deep keel and straight breastbone; horizontal carriage; rather long back; full round breast; fairly long wings carried closely to the sides and with broad flight feathers; fully furnished tail with long, broad, and nicely curved sickles, and set on at an angle of 45 degrees

Legs.—Of medium length, but without any tendency to stiltiness. Shanks strong but fine bone, free of feathers, straight and wide apart, no tendency to "knock-knees." Toes (four) long, fine, and well spread.

Carriage.—Upright, active, and alert.

Weight.—6 lb. to 8 lb.

THE HEN.

With the exception of the single comb (which is carried gracefully over one side so as not to obstruct the sight), the general characteristics are similar to those of the cock, allowing for the natural sexual differences.

Weight.—5 lb. to 7 lb.

Colour.

THE BLACK.

Beak dark horn. Eyes dark. Comb, face, and wattles blood-red, the face totally devoid of white or blue skin. Ear-lobes perfectly white. Legs and feet black or very dark slate, the latter in adult birds only.

Plumage.—Brilliant green-black.

THE WHITE.

Beak white. Eyes red. Comb, face, and wattles blood-red. Ear-lobes white. Legs and feet pink-white.

Plumage.—Lustrous silver-white.

Scale of Points.

The Single Comb.

Head (face 15, comb 15, lobes 10)	40
Colour (plumage 10; legs, eyes, and beak 8)	18
Type	17
Size	15
Condition	10
	100

Serious Defects.—White or blue in face; wry or squirrel tail; feathers on shanks or toes; other than four toes; side sprigs on comb; plumage other than black or white; legs other than black or dark slate in Blacks; or white in Whites.

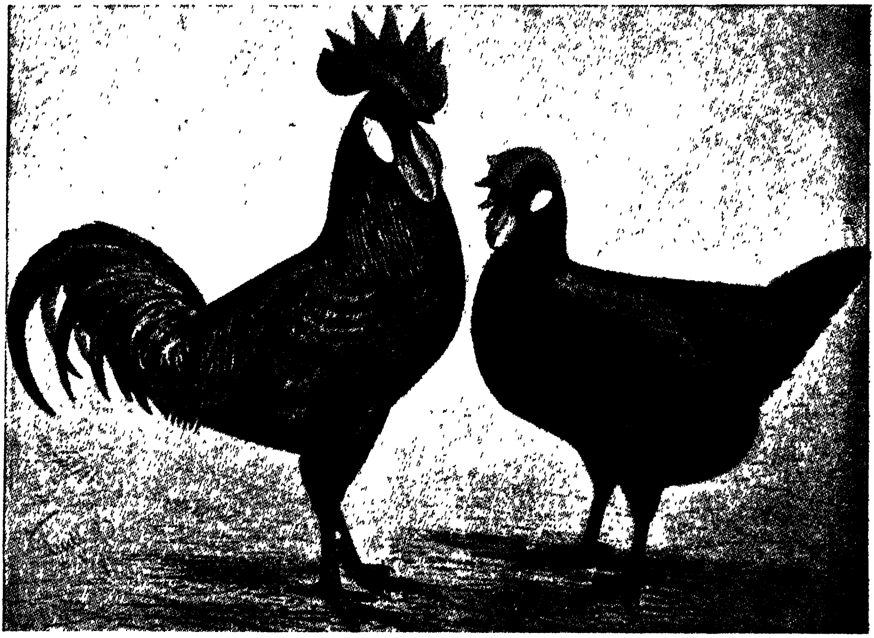


Plate 142.
MINORCAS.

There is little known of the origin of this breed. It is generally accepted that the Minorca is a descendant from the Castilian fowl. Its name is derived from the Island of Minorca, off the East coast of Spain, from where the first importations into Britain were made.

The Minorca has the inherent characteristic for good egg size. It is generally accepted that the average weight of eggs laid by this breed is greater than that of eggs laid by most other breeds.

The Minorca is possibly the largest of the Mediterranean or light breeds, and being white skinned is attractive when dressed for table purposes. However, its black pin feathers are objectionable.

The Minorca, although well known, has not been persevered with to any extent by commercial poultry farmers. Backyard poultry keepers who have a preference towards white shelled eggs would find the Minorca admirable for this purpose.

This breed is noted for its long back, the shoulders being broad and the body reasonably deep and having somewhat of an oblong, compact appearance, as the feathering is fairly close. The male has a sloping back, with a reasonably long flowing tail which sets off its body and gives it a somewhat racy and active appearance. The back of the female is nearly horizontal, and the tail carried fairly low.

The breed is also noted for the large combs, wattles, and the outstanding characteristic of large white earlobes. The comb should not be excessively large and beefy. Smallness of earlobes is another common fault, more particularly among the utility Minorcas.

Varieties.

The Black (Plate 142).—The black is common in Queensland. Little difficulty is experienced in breeding this variety, but there are some characteristics that must be guarded against. Some of the principal faults are as follows:—Light coloured eyes, such as reddish or hazel, in-knees, light undercolour, small lobes.

There is also a tendency towards white in face or blue in face, but these points are not quite so common as those previously mentioned. The standard calls for a brilliant green sheen on the plumage. The plumage, as a general rule, particularly in the female, is a dull black colour. At one time purple sheen, or barring, was fairly prevalent. This fault has been practically bred out, but should always be avoided where possible in the selection of breeding stock.

The White.—This variety is very uncommon in Queensland.

[TO BE CONTINUED.]

MEMBERS OF THE WARWICK JUNIOR FARMERS' CLUB WITH LOCAL SUPPORTERS.

MARKETING

Stabilising the Wheat Market.

H. S. HUNTER, Director of Marketing.*

"THE Wheat Market." What visions the phrase conjures up of hectic buying and selling in the great grain exchanges of the world! Chicago! The Baltic! Of fortunes made and lost. The fever that grips the operator when sudden price movement, or news of quick change in supply or demand prospects, holds promise of handsome profit for prompt action in the right direction, or heavy loss for the ill-informed or unlucky speculator. The "Bulls" and the "Bears"; "Hedges" and "Futures." This coloured the picture of a not so distant generation. It was reflected in popular fiction. The system was motivated by the hope of gain, and held an appeal for the adventurous. The welfare of the producer and of the consumer had no conscious place in such a system of trading, but it nevertheless served a necessary purpose. By its operation production was equated with demand, value was ascertained, and the international flow of wheat was rendered possible. If the benefits accruing to the producer and the consumer were purely incidental, they were none the less real.

However, the system was shown to have its limitations. Two world wars with an intervening economic depression have demonstrated that speculative trading in wheat is unable of itself to meet national needs in abnormal times. In fact, its suitability for the needs of the modern world has been called into question. Wheat means bread, the staple food of Western peoples and of an increasing number of Asians. In time of war is becomes as important as armaments, and in times of peace its importance as a vital foodstuff is such that its regular supply cannot be allowed to fail because for a period it may become uneconomic for farmers to produce wheat.

During the depression years, wheatgrowing in Australia became so unprofitable that the Federal Government paid to wheatgrowers in bounties and other forms of assistance a sum of over £18,700,000 during the years 1932 to 1940. Wheatgrowers in other countries were likewise assisted by their Governments at that time; for example, the New Deal legislation for agriculture in the United States.

From that time unremitting efforts have been made in Australia and in other wheat exporting countries to stabilise their wheatgrowing industries and to bring about an international agreement covering the trading in wheat.

Difficulties have been encountered in both the national and the international spheres because of the conflicting interests involved, but the position has been reached this year when a Wheat Industry

* In an A.B.C. "Country Hour" talk.

Stabilisation Scheme will operate in Australia concurrently with an International Wheat Agreement between certain of the wheat exporting and wheat importing countries.

In Australia, the Wheat Industry Stabilisation Scheme, which replaced the wartime scheme operated under the National Security Act, is based upon complementary legislation passed by the Commonwealth and State Governments in 1948 after the proposals had received an affirmative vote of wheatgrowers.

The scheme, which is without the acreage limitations of the wartime plan, is to operate for a period of five years up to the end of the 1952-53 season. It provides that the Commonwealth Government for its part shall guarantee the price of wheat placed on the export market through the Australian Wheat Board and the Board's licensed receivers in the States.

The guaranteed price shall be on the basis of 6s. 3d. per bushel f.o.r. ports, bulk basis, the ascertained cost for the 1947-48 season for wheat grown and delivered by wheatgrowers; with variations according to an index of production costs for each season starting with the 1948-49 crop. The guaranteed price for the 1948-49 season has been fixed at 6s. 8d. per bushel f.o.r. ports, bulk basis. The guarantee is for a maximum of 100 million bushels from any one season's crop. A stabilisation fund has been established by means of a tax on wheat exported. This is paid into the fund to help meet the guaranteed price. If it is insufficient, the Commonwealth Treasury has to pay the balance. The tax applies when the export price is higher than the guaranteed price, and consists of 50 per cent. of the difference between the two prices, but is not to be greater than 2s. 2d. a bushel.

The States for their part undertake to fix a home consumption price for wheat at the same level as the export price guaranteed by the Commonwealth.

In the international sphere, substantial agreement has been reached by the importing countries and by a majority of the exporting countries with the result that an International Wheat Agreement (excluding Argentina, Russia and the Danubian countries) has been signed by the representatives of 5 exporting countries and 36 importing countries.

The agreement, which follows an unsuccessful attempt to reach agreement in 1948, is for a period of four years dating from the 1st August, 1949, and covers a quantity of 436 million bushels (or slightly less) of wheat annually. This is only approximately half, or not half, of the international trade in wheat, which may vary from 750 million bushels to 1,000 million bushels each year.

However, it is a beginning and has been described by the United States Department of Agriculture as an attempt, by introducing an element of stability into the world wheat trade, to overcome the hardship caused to producers and consumers by burdensome surpluses and critical shortages of wheat. The five exporting countries include France and Uruguay, but they account for only 5 million bushels of the export total between them. The others are Canada, with a quota of 203 million bushels; the United States, with 168 million bushels; and Australia, with 80 million bushels.

Of the 36 importing countries which have signed the agreement, the United Kingdom, with over 177 million bushels, has by far the largest annual import quota. Other countries with 20 million bushels, or more, are Italy, 40 million; India, 38 million; Netherlands, 25 million; and Belgium, 20 million.

The agreement provides for basic maximum and basic minimum prices, with the minimum decreasing on a sliding scale until the conclusion of the agreement in 1952-53. Taking transportation costs and exchange rates into consideration, the prices when expressed in Australian currency for wheat f.o.b. Australian ports at freight rates operating when the agreement was signed, were approximately a maximum of 11s. 2d. a bushel and a minimum of 7s. 2d. a bushel. Devaluation of the Australian pound has since raised these prices in terms of Australian currency to approximately 16s. 1d. a bushel and 12s. 1d. a bushel.

One of the main features of the agreement is that exporters are obliged to sell wheat up to their quota at the maximum prices prescribed and importers are obliged to buy wheat up to their respective quotas at minimum prices. Between the floor and ceiling prices wheat is free to move at prices agreed between buyer and seller. The contracting countries may engage in wheat trading outside the scope of the agreement provided they fulfil their obligations under the agreement.

So when we refer to the wheat market today we refer to something more than speculative buying and selling of this commodity, and include mutual planning between nations to safeguard the welfare of their producers and consumers.

In Queensland, we have had a system of organised marketing for wheat in operation for the past 29 years. This system is being continued and now occupies its modest place in the larger Commonwealth and International Schemes.

BRISBANE TOBACCO SALES.

At the conclusion of the October-November sales of South Queensland tobac leaf, conducted in Brisbane for the Tobacco Leaf Marketing Board, the Minister f Agriculture and Stock (Hon. H. H. Collins) said that prices had been genera. satisfactory.

Approximately 400,000 lb. was offered, half of this being leaf which had been passed in at the August sales through failure to attract the reserve price.

Some 350,000 lb. was cleared at the sale, at an average price of 52d. per lb.; the remaining 50,000 lb. of damaged leaf was being cleared satisfactorily by private treaty.

Mr. Collins said that it would be gratifying to Queensland producers to know that the leaf which was passed in at the August sale realised rather more than 10d. per lb. above the price offered in August.

ASTRONOMICAL DATA FOR QUEENSLAND.

JANUARY.

Supplied by W. J. Newell, Hon. Secretary of the Astronomical Society of Queensland.

TIMES OF SUNRISE AND SUNSET.

At Brisbane.			MINUTES LATER THAN BRISBANE AT OTHER PLACES.					
Day.	Rise.	Set.	Place.	Rise.	Set.	Place.	Rise.	Set.
	a.m.	p.m.						
1	4.56	6.46	Cairns	48	9	Longreach	43	27
6	5.00	6.47	Charleville ..	29	25	Quilpie	33	37
11	5.04	6.47	Cloncurry	63	36	Rockhampton ..	18	2
16	5.08	6.47	Cunnamulla ..	28	31	Roma	19	15
21	5.12	6.46	Dirranbandi ..	16	22	Townsville ..	40	9
26	5.16	6.45	Emerald	27	12	Winton	51	30
31	5.20	6.43	Hughenden ..	48	22	Warwick	2	6

TIMES OF MOONRISE AND MOONSET.

At Brisbane.		
Day.	Rise.	Set.
	p.m.	a.m.
1	4.11	1.54
2	5.10	2.36
3	6.08	3.24
4	7.02	4.19
5	7.51	5.19
6	8.35	6.23
7	9·14	7.27
8	9.49	8.30
9	10.22	9.33
10	10.54	10.35
11	11.28	11.37
		p.m.
12	..	12.41
	a.m.	
13	12.04	1.47
14	12.44	2 55
15	1.31	4.04
16	2.25	5.09
17	3.26	6.08
18	4.30	7.00
19	5.36	7.44
20	6.39	8.21
21	7·39	8.54
22	8.35	9.23
23	9.29	9.50
24	10.22	10.17
25	·11·14	10.46
	p.m.	
26	12.07	11.16
27	1.02	11·50
28	1.59	..
		a.m.
29	2.56	12.29
30	3.54	1.14
31	4·50	2.06

MINUTES LATER THAN BRISBANE (SOUTHERN DISTRICTS)

Charleville 27; Cunnamulla 29; Dirranbandi 19;
Quilpie 35; Roma 17; Warwick 4.

MINUTES LATER THAN BRISBANE (CENTRAL DISTRICTS).

Day.	Emerald.		Longreach.		Rockhampton.		Winton.	
	Rise.	Set.	Rise.	Set.	Rise.	Set.	Rise.	Set.
1	10	28	26	43	0	19	28	52
6	12	29	27	44	2	19	30	52
11	23	17	39	32	14	8	44	37
16	30	9	46	23	21	0	46	3
21	24	15	41	30	16	6	47	35
26	14	25	29	41	4	17	33	49
31	9	30	25	45	0	21	26	54

MINUTES LATER THAN BRISBANE (NORTHERN DISTRICTS).

Day.	Cairns.		Cloncurry.		Hughenden.		Townsville.	
	Rise.	Set.	Rise.	Set.	Rise.	Set.	Rise.	Set.
1	6	50	35	63	20	49	6	42
3	2	56	33	67	17	53	3	46
5	6	55	35	67	20	52	6	45
7	15	46	40	61	25	47	14	38
9	26	35	47	55	32	40	22	30
11	37	24	55	46	40	31	31	21
13	43	11	59	38	44	23	36	11
15	53	3	67	32	50	18	44	4
17	56	2	68	32	52	17	46	3
19	51	9	65	36	49	22	42	9
21	42	19	58	43	43	28	35	17
23	31	30	51	50	35	35	25	25
25	20	39	44	57	29	42	18	34
27	11	49	38	63	23	49	10	41
29	3	55	34	67	18	52	4	45
31	2	56	33	67	17	53	3	46

Phases of the Moon.—Full Moon, 4th January, 5.48 p.m.; Last Quarter, 11th January, 8 [illegible]1 p.m.; New Moon, 18th January, 5.59 p.m.; First Quarter, 26th January, 2.39 p.m.

On 15th January the Sun will rise and set 23 degrees south of true east and true west pectively, and on the 10th and 23rd the Moon will rise and set at true east and true west pectively. On the 3rd the Earth will be in perihelion, its nearest approach to the Sun.

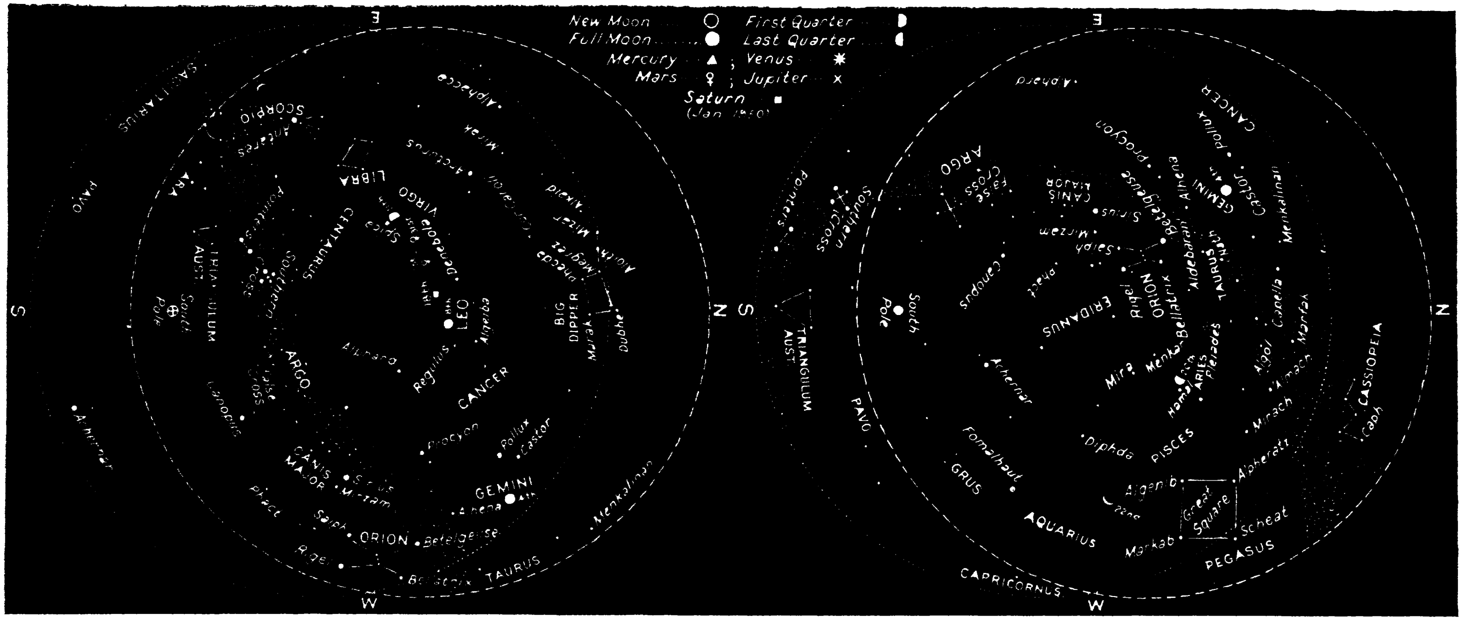
Mercury.—In the constellation of Capricornus, at the beginning of the month, will set h. 15 m. after the Sun and will be in line with the Sun on the 18th, after which it will pass into the morning sky and by the end of the month, in the constellation of Sagittarius, will rise 1½ h. before sunrise.

Venus.—Now rapidly approaching the Sun; at the beginning of January setting 2¼ h. after the Sun, while at the end of the month it will be in conjunction with the Sun and set about Sunset.

Mars.—Rising before midnight in the constellation of Virgo. On the 1st it will rise just before midnight, but at the end of the month will rise between 9.45 p.m. and 11 p.m.

Jupiter.—Reaches conjunction with the Sun early next month, so is not favourably placed for observation. On the 1st it will set 1½ h. after the Sun and on the 25th will pass 7 degrees to the South of Venus. At the end of the month will set only 11 m. after Sunset.

Saturn.—At the beginning of the month will rise between 10.30 p.m. and 11.45 p.m., while at the end of the month will rise between 8.30 p.m. and 9.45 p.m.



Star Charts.—The chart on the right is for 8.15 p.m. in the south-east corner of Queensland to 9.15 p.m. along the Northern Territory Border on the 15th January. (For every degree of longitude we go west the time increases by 4 minutes.) The chart on the left is for 7 hours later. On each chart the dashed circle represents the horizon as viewed from Cape York and the dotted circle is the horizon for places along the New South Wales Border. When facing north hold "N" at the bottom; when facing south hold "S" at the bottom, and similarly for the other directions. Only the brightest stars are included and the more conspicuous constellations named. The stars, which do not change their relation to one another, moving east to west, arrive at any selected position about 4 minutes earlier each night. Thus, at the beginning of the month, the stars will be in the positions shown about 1 hour later than the time stated for the 15th, and at the end of the month about 1 hour earlier than that time. The positions of the moon and planets, which are continually changing in relation to the stars, are shown for certain marked days. When no date is marked the position is for the middle of the month.

Vol. 69 Parts 1 to 6

QUEENSLAND AGRICULTURAL JOURNAL

GENERAL INDEX.

INDEX TO ILLUSTRATIONS.

AUTHOR INDEX.

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